

6th Annual Science & Engineering Technology Conference,
Charleston, SC.

19-21 April 2005

International Technology Cooperation by Adrian Baguley

FY 2006 President's Budget Request for the Defense S&T Program by Mr. Robert W. Baker

Defense Basic Research by Dr. Bill Berry

AFRL - Towards the Next Horizon by Dr William U. Borger

Urban Warfare Discussion by Mr. Joe Braddock

Biological/Chemical Countermeasures RDT&E: at the Department of Homeland Security by Mr. Lance Brooks

Defense Threat Reduction Agency Science and Technology Programs by Dr. Mark Byers

The Vision and Technology Plan for the Integrated Manned and Unmanned Rotorcraft Fleet by Mr. Ned Chase

Fighting the Networked Force: Insights from Network Centric Operations Case Studies by Lt Col Jack "Ripper" Forsythe

Capability Based Approach to Joint Warfighting by RDML Mark Harnitchek

Defense Science and Technology Crosscutting Challenges and Opportunities by Dr. Charles J. Holland

Navy S&T Focus by CAPT J.C. Kamp

Focus of the Army Science & Technology Program by Dr. Thomas Killion

Army Science & Technology by Dr. Thomas Killion

Integrated Solutions to Deter/Defeat Threats to U.S by COL Klooster

DARPA's S&T Program by Dr. Robert Leheny

Getting Technology to the Warfighter - Bridging the Gap From Research to Applications by Dr. Robert F. Leheny

Department of Homeland Security Science & Technology Directorate Border and Transportation Security Portfolio by Ms. Jeanne Lin

Joint Capabilities Integration & Development System - Urgent Needs & JCIDS

United States Joint Forces Command - Emerging Concept for Joint Command and Control by Mr. David J. Ozolek

Getting Technology to the Warfighter by Ms. Sue Payton

Advanced Concept Technology Demonstration (ACTD) by Mr. Mark Peterson

Research and Technology Needs - Focus on: Force Protection Combating Terrorism Surveillance Technology by Mr. Ben Riley

Test and Evaluation/Science and Technology (T&E/S&T) Program by Mr. George Rumford

Defense Research and Engineering Update by Dr. Ronald M. Sega

Disruptive Technology: An Uncertain Future by Mr. Alan R. Shaffer

Discovery to Deployment

International Technology Cooperation

Adrian Baguley

Defence Science and Technology Counsellor

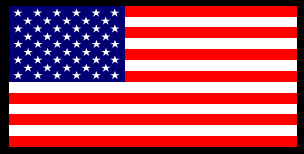
British Embassy

UK science|innovation|technology

Outline

- **UK Ministry of Defence Science and Technology**
- Why Cooperate?
- US/UK Cooperation
- The Technical Cooperation Program

DoD / MoD Comparison



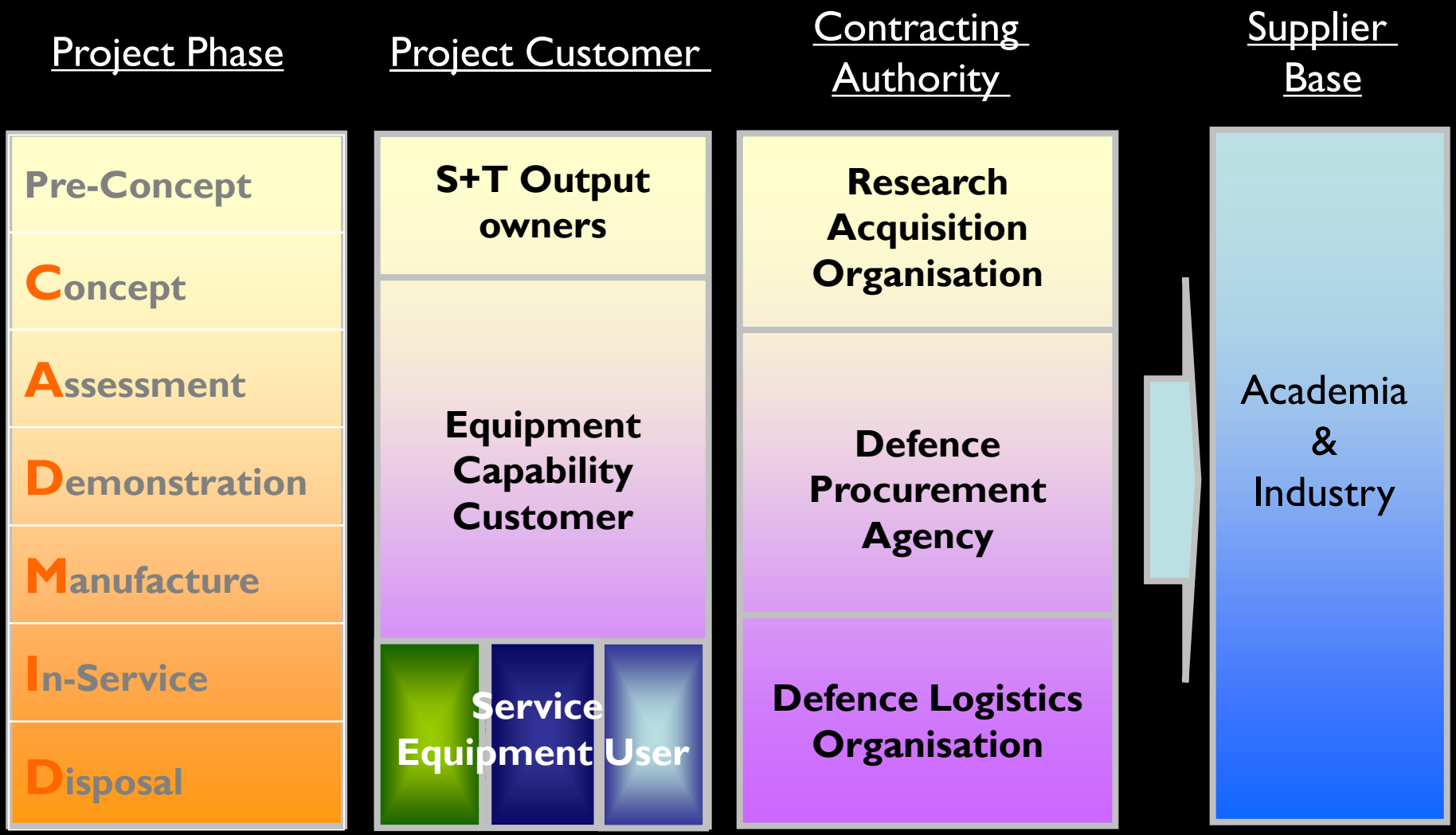
- $442Bn ($148Bn proc/RDT&E)
- 3.3% of GDP
- Strong Congressional influence
- Single-services train and equip
- Widespread acquisition community
- Several major prime contractors



- $57Bn ($16Bn procurement, etc)
- 2.4% of GDP
- Little legislative influence
- Tri-service requirements, research and acquisition
- Focused acquisition community
- Single major national defence prime contractor

Common defence goals, but varying approaches:
collaboration provides diversity of approach, as well as of technology

Acquisition in the UK

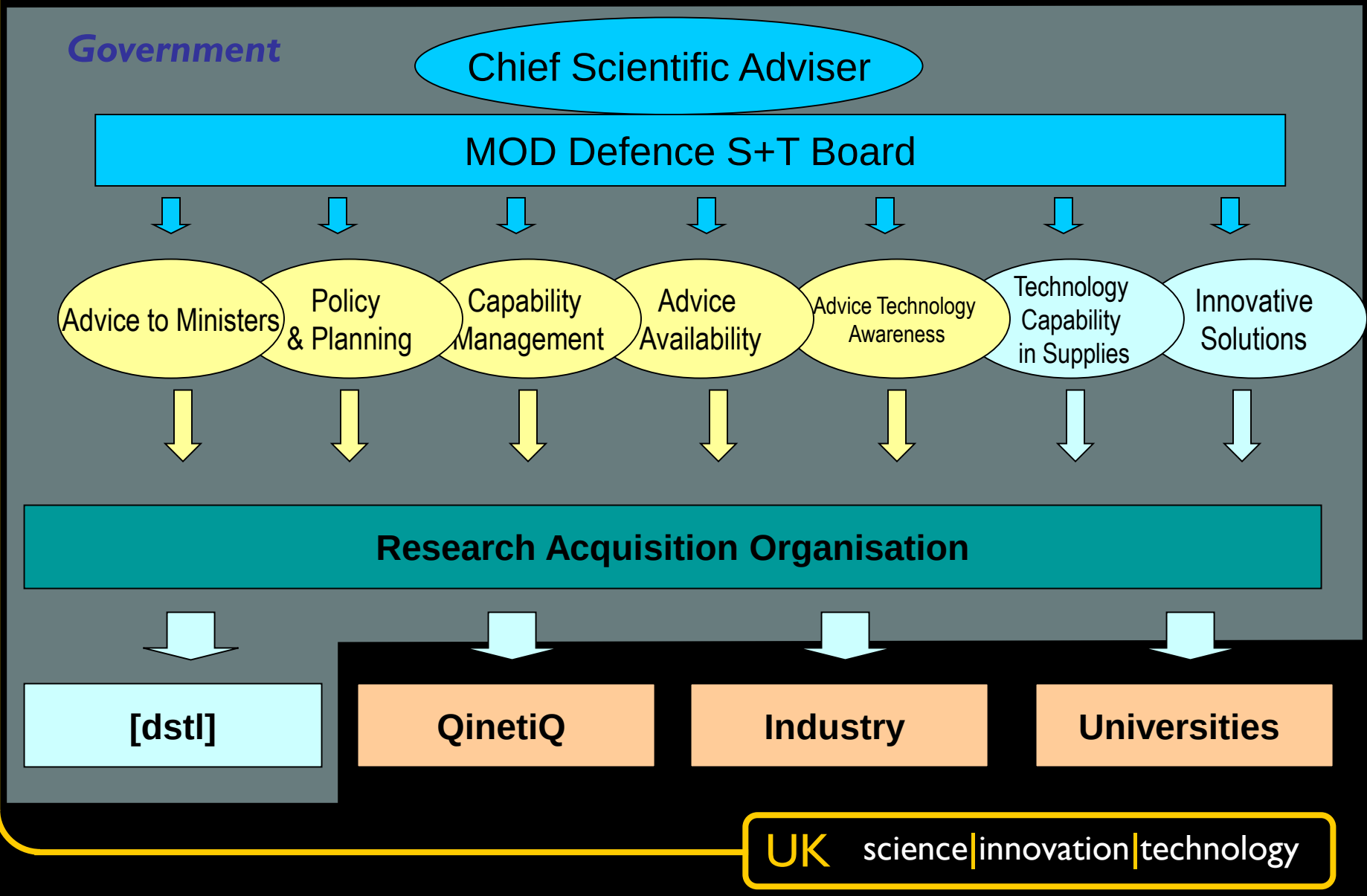


UK science|innovation|technology

History of UK Defence Laboratories



Output Based Research



UK science|innovation|technology

UK Science & Technology Priorities

For Directed Research

- Command structures and decision support for NCW
- Information and data management
- Detection and identification of difficult targets, BDA and Combat Id
- Unmanned systems
- Precision weapons, including for HDBT
- CBR detection and countermeasures
- Improved mobile communications
- Recruitment, retention, reduced manning and duty of care
- Detection and disruption of explosive devices
- Technology Insertion
- Modelling and simulation for effects based operations, experimentation, urban ops, human systems and logistics supply chain

UK Science & Technology Priorities

For Innovative Research

- Autonomous systems
- Wireless sensor networks
- Generic biological detection and countermeasures
- Novel sensor and processing technology
- Active or Multifunctional material technologies
- Technology enabling low cost, low maintenance or high availability systems
- Technologies to reduce environmental impact
- Information systems
- Power Sources

Defence Technology Centres

- Development of enabling-level technologies
- Formal collaboration between MoD, industry and academia

Data Information Fusion Defence Technology Centre

EM Remote Sensing Defence Technology Centre



UK science|innovation|technology

Towers of Excellence

- Partnership with industry
- Focus resources on priority areas
- Improve transition and pull-through











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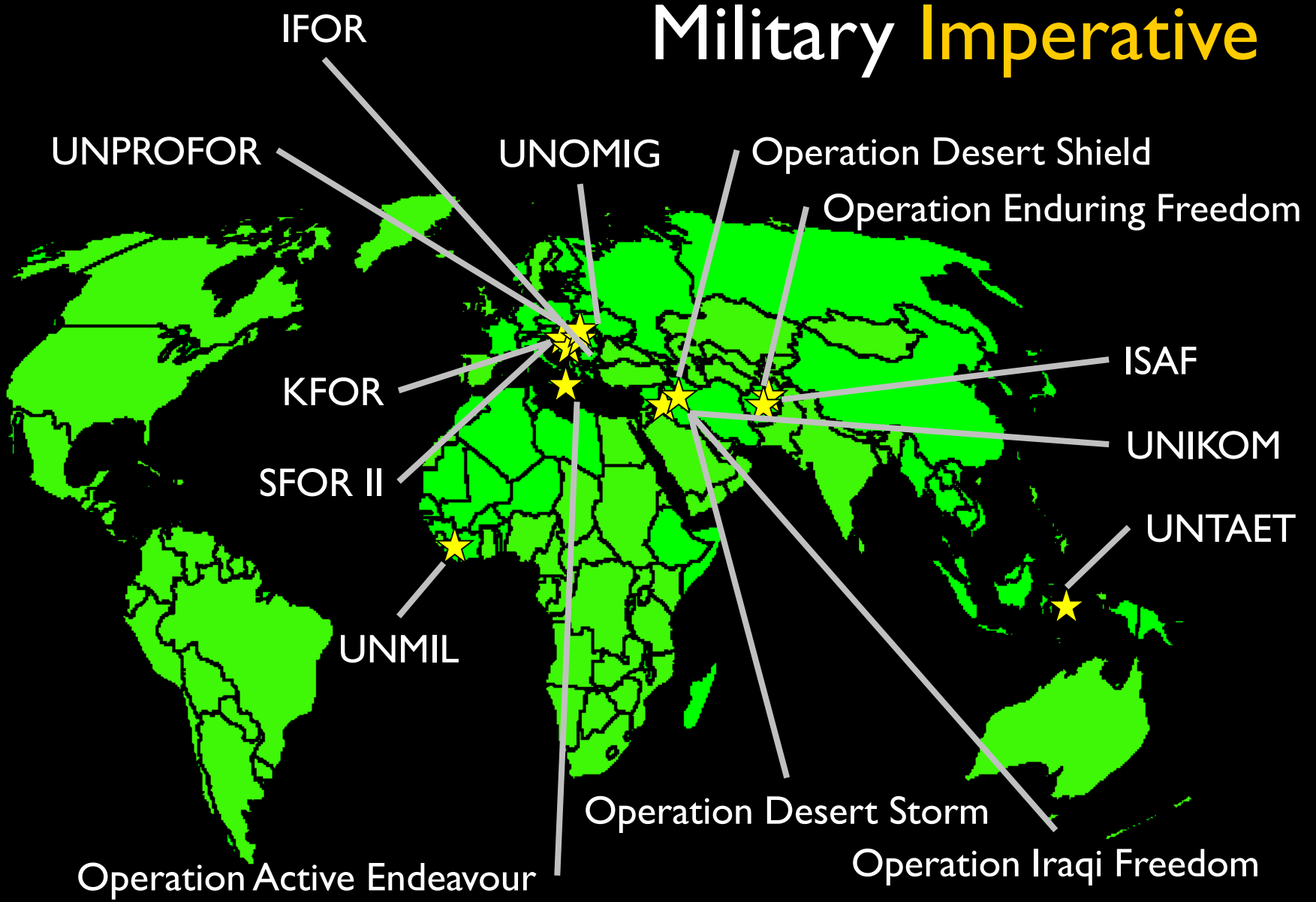
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- **Why Cooperate?**
- US/UK Cooperation
- The Technical Cooperation Program

Why Cooperate?

- Military Imperative
  - Improved interoperability
  - More capable allies – increased burden-sharing
  - Lessons identified / learnt
- Fiscal Imperative
  - Reduced research and acquisition costs
- Intellectual Imperative
  - Wider intellectual pool
  - Peer review
- Technology Imperative
  - Access to unique capabilities
  - Improved technology access

Military Imperative



(Combined US & UK Military Operations since 1990)

March 2003 - Iraq

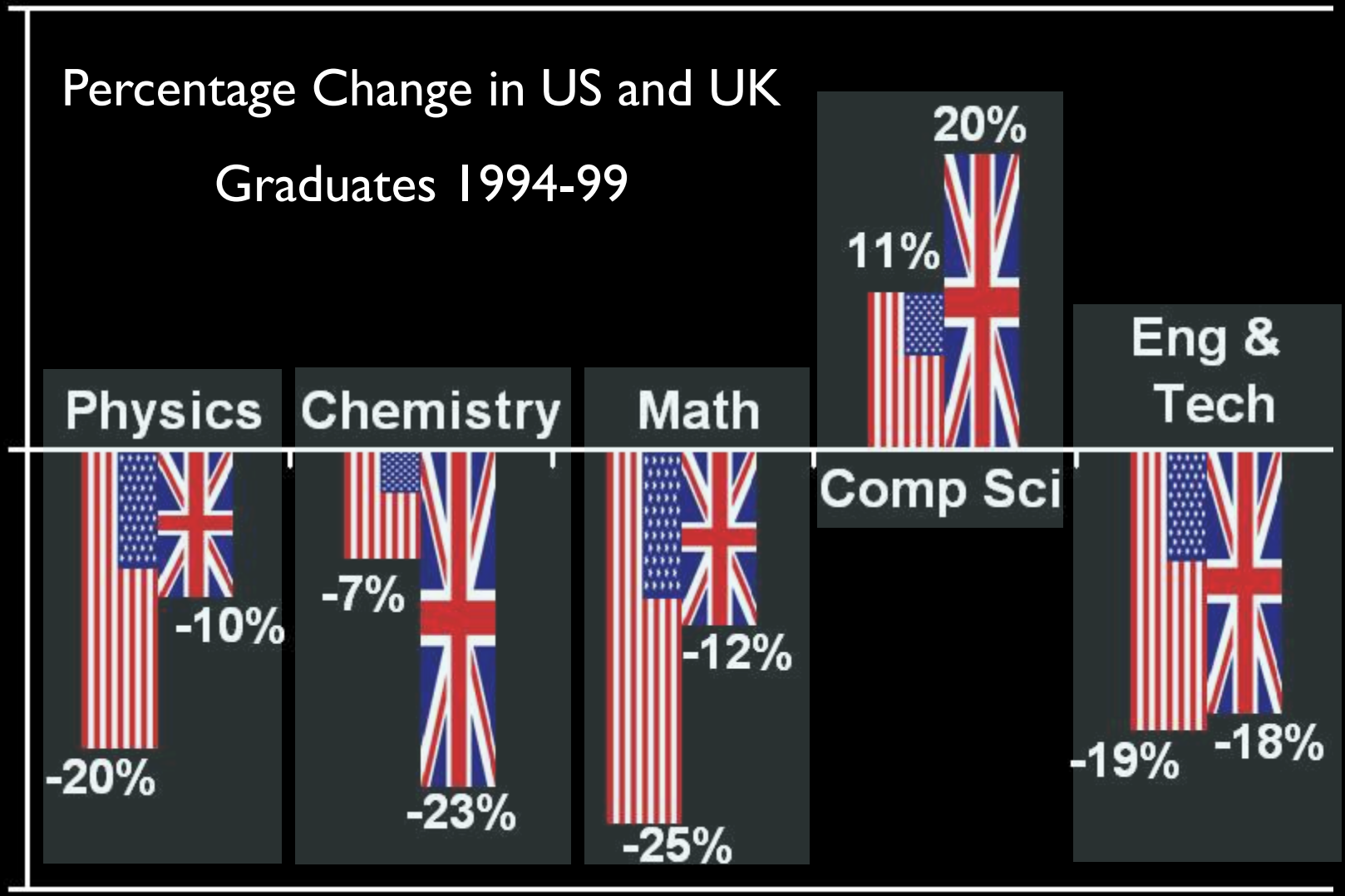


1 Marine Expeditionary Force

3 Commando Brigade

15 Marine Expeditionary Unit

Intellectual Pool

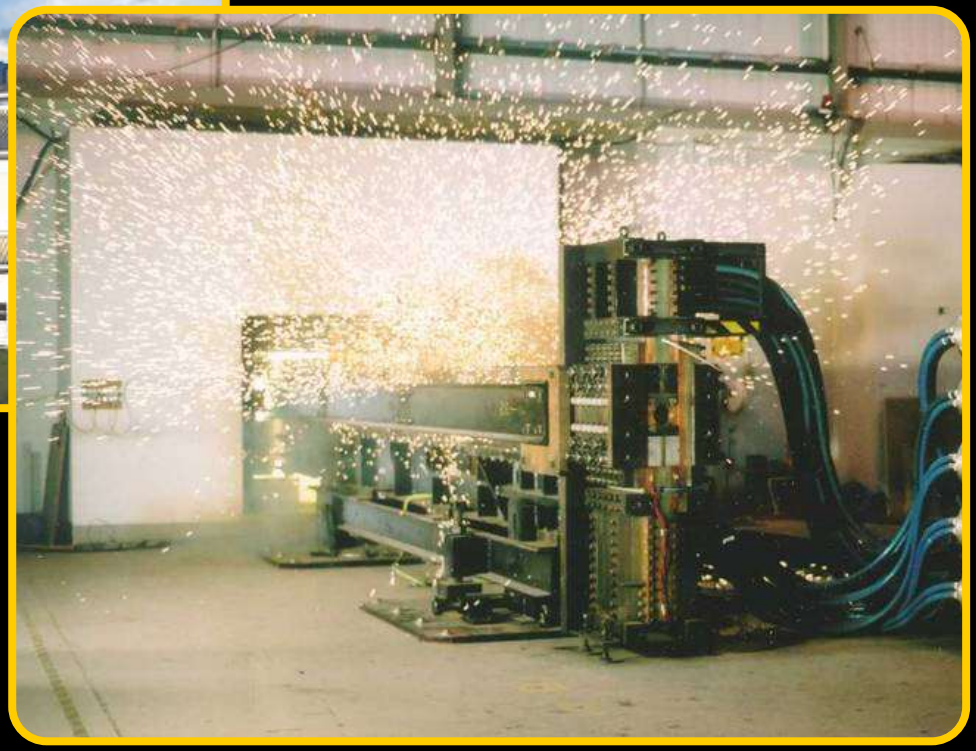


Fiscal Pressures

- Defence budgets under increasing pressure from other priorities in government spending plans
- Within Defence Budgets S+T is under increasing pressure from other priorities (e.g. O&M)
  - DOD S+T funds requested in 2006 lower than 2005 request
  - UK Defence S+T budget has seen a steady decline in real terms over the last decade

Unique Capabilities





UK science|innovation|technology

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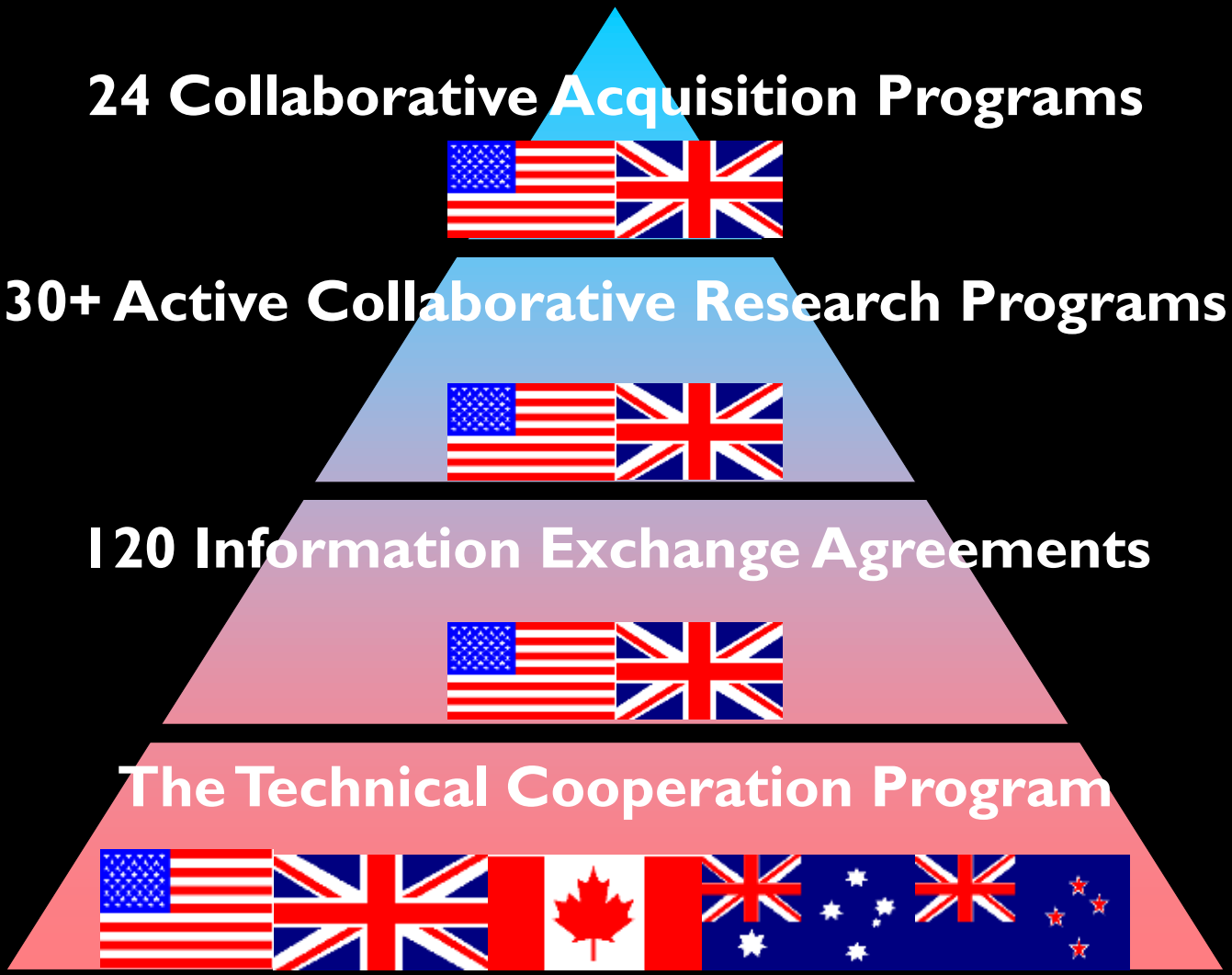
1958 Mutual Defense Agreement

- Underpins all exchanges between the US and UK on nuclear weapon and nuclear propulsion.
- Very strong links between UK Atomic Weapons Establishment and US nuclear labs.
- Excellent example of benefits of collaboration (access to unique capabilities, complementary approaches, peer review, etc)





US – UK Collaborative Framework



Cooperative Research Programmes

(12 new programmes totaling >$230m commenced in 2004)











International Technology Alliance



- A new model of collaboration
- UK/US government, industry and academic partnership
- Network & Information Sciences
  - Network Theory
  - Security across a system of systems
  - Sensor information processing and delivery
  - Distributed coalition planning and decision making
- Competition in progress – ITA begins work early 2006

Challenges

- Disparity in funding
  - Need to focus on mutual capabilities and ensure we burden-share
- Different approaches to S+T
  - UK analysis vs US demonstration – can be complimentary
- Transitioning cooperative research
  - Need earlier industry engagement
- Export controls
  - Bilateral Defense Acquisition Committee established by President and Prime Minister to address barriers

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TTCP

AUS – 1965

NZ - 1969



CA – 1957

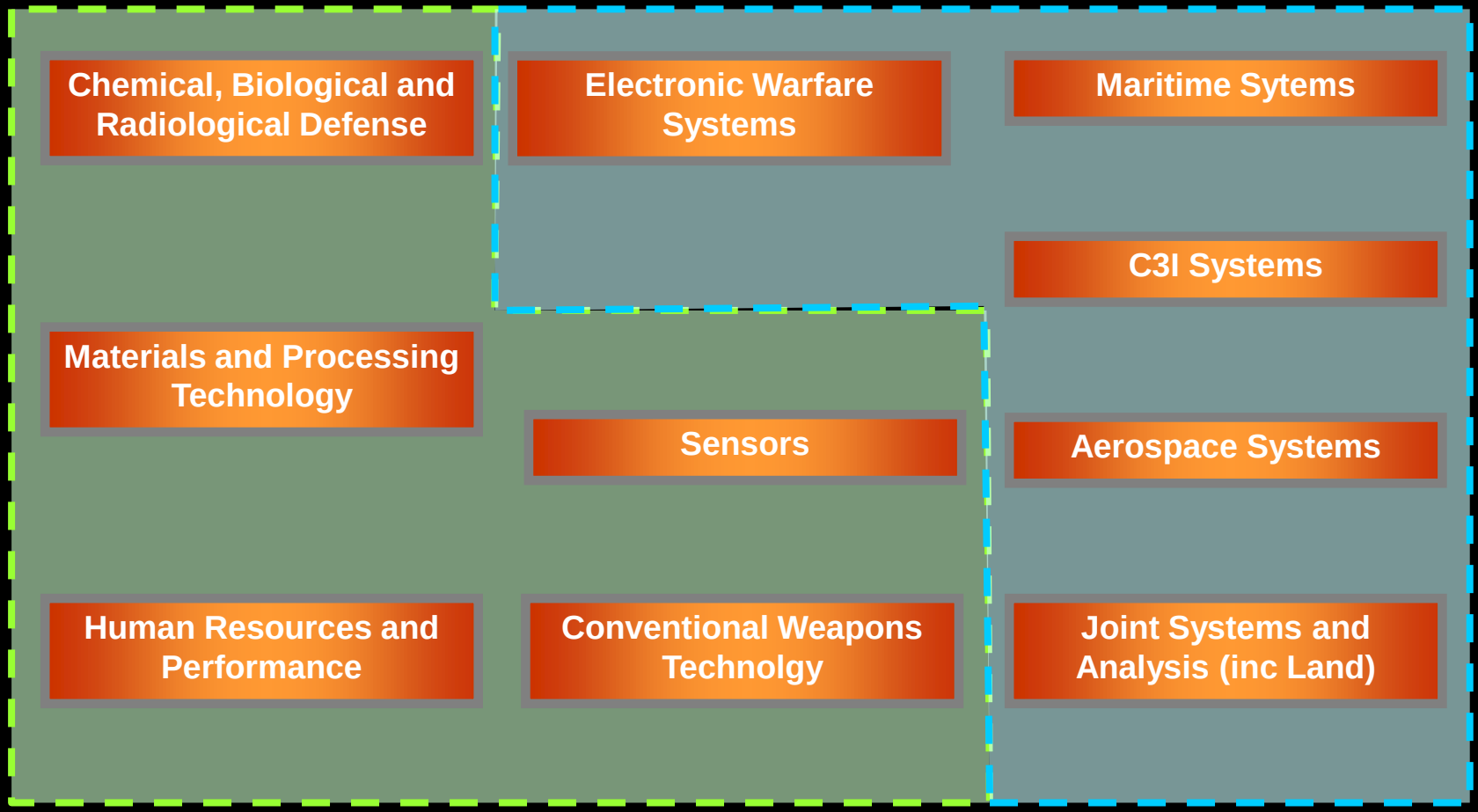
UK – 1957

US – 1957

TTCP Aims

- Harmonize S&T programmes
  - avoid duplication
- Supplement each nation's program with knowledge and resources of others
  - Information exchange
  - Joint trials and experimentation
  - Joint projects
- Provide best technical information for advice
- Enabler for Coalition warfare / interoperability
  - S&T collaboration a starting point for joint development and interoperability

TTCP


Chemical, Biological and Radiological Defense
Electronic Warfare Systems
Maritime Sytems
C3I Systems
Materials and Processing Technology
Sensors
Aerospace Systems
Human Resources and Performance
Conventional Weapons Technolgy
Joint Systems and Analysis (inc Land)

TTCP - *The Global Laboratory*

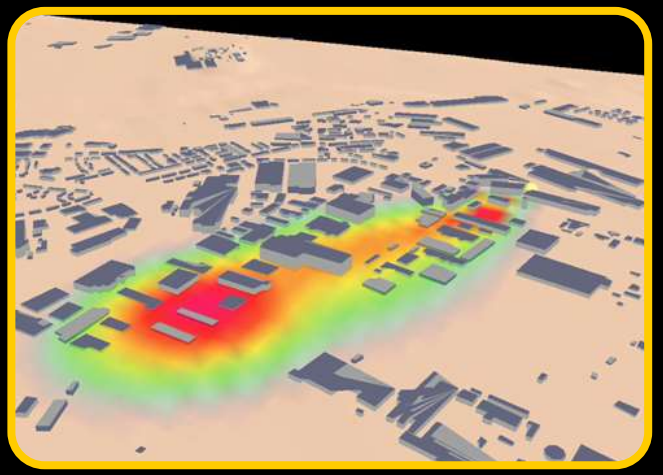


- **5** Nations
- **10** Technology and Systems Groups
- **80** Technical Panels & Action Groups
- **170** national organisations on **450** sites
- **300** active TTCP work strands
- **1,200** scientists and engineers directly engaged
- **6,000** + scientists and engineers accessed

Value of working together – Priceless!

TTCP Highlights

- Urban Dispersal Models



- Certification Of Bonded Structures



TTCP Highlights

- Radar Detection of Submarine Periscopes



- Coalition Network Management



Questions?

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Defense Basic Research

NDIA: 6th Annual S&E Technology Conference

Presented by

Dr. Bill Berry

Acting Deputy Under Secretary of Defense

(Laboratories and Basic Sciences)

19 March 2005

Defense Basic Research

- *Why do Basic Research in DoD?*
- *Management of DoD Basic Research*
- *Basic Research in context of Defense RDT&E*
- *Services and DARPA's Basic Research Programs*
- *Summary*

Main Purposes for Defense Basic Research

- *Generate new knowledge and understanding as foundation for future defense technologies*
- *Train scientists and engineers in key disciplines for defense needs*
- *Sustain research infrastructure needed for continued performance of cutting-edge defense research*

DoD's Basic Research Program

Competitive, multifaceted program to enable revolutionary ideas
- University based, single investigators, broad areas
- In-house laboratories for "smart buyer" and "essential capabilities"
- Industry and services to exploit results

Flexible, balanced portfolio
- Long-term, mission orientation
- Engineering emphasis (at least 50 percent)
- Stable commitment to key capabilities (e.g., sensors)

Infrastructure support
- University personnel and students
- Laboratories (lean, modern, focused)

Planning and oversight
- Link to top-down elements (S&T Strategy, DTAP, JWSTP, DTOs)
- Basic Research Review
- Service reviews, peer and merit reviews

Basic Research is Focused in Areas Important to Defense

- ***Invest in broad base of DoD-relevant areas across scientific and engineering disciplines***

- ***Broad base is complemented by six Strategic Research Areas, some of most exciting areas with high potential for DoD benefit:***

Bioengineering Sciences
Human Performance Sciences
Information Dominance
Multifunction Materials
Nanoscience
Propulsion and Energetic Sciences

- ***Complements other Federal agency investments.***

For example, while DoD provides only about 6% of total Federal investment in basic research, it provides:

75% of Federal basic research funding in electrical engineering
66% of funding in mechanical engineering
40% of funding in mathematics and computer science

Management of DoD Basic Research

- ***Basic Research Plan*** provides vision & strategy for planning & execution

- ***Three levels of*** DoD management ***oversight***
  - ***DSTAG*, Defense S&T Advisory Group**
    DDR&E's S&T executives for *major issues*
  - ***DBRAG* Defense Basic Research Advisory Group**
    Service and other research office senior managers provides leadership and oversight on *other cross-cutting issues*
  - ***SPGs Scientific Planning Groups***
    program managers *coordinate programs* across Services & DARPA

- ***Defense Basic Research Review*** — every two years, an external and multi-Agency panel reviews DoD research quality, relevance & emphases

- DoD Basic Research Office got ***OMB's highest "Effective" rating*** recently
  a rating achieved by only 11% of the 400 OMB-reviewed programs (which collectively account for 40% of the Federal budget)

FY06 RDT&E Budget Request

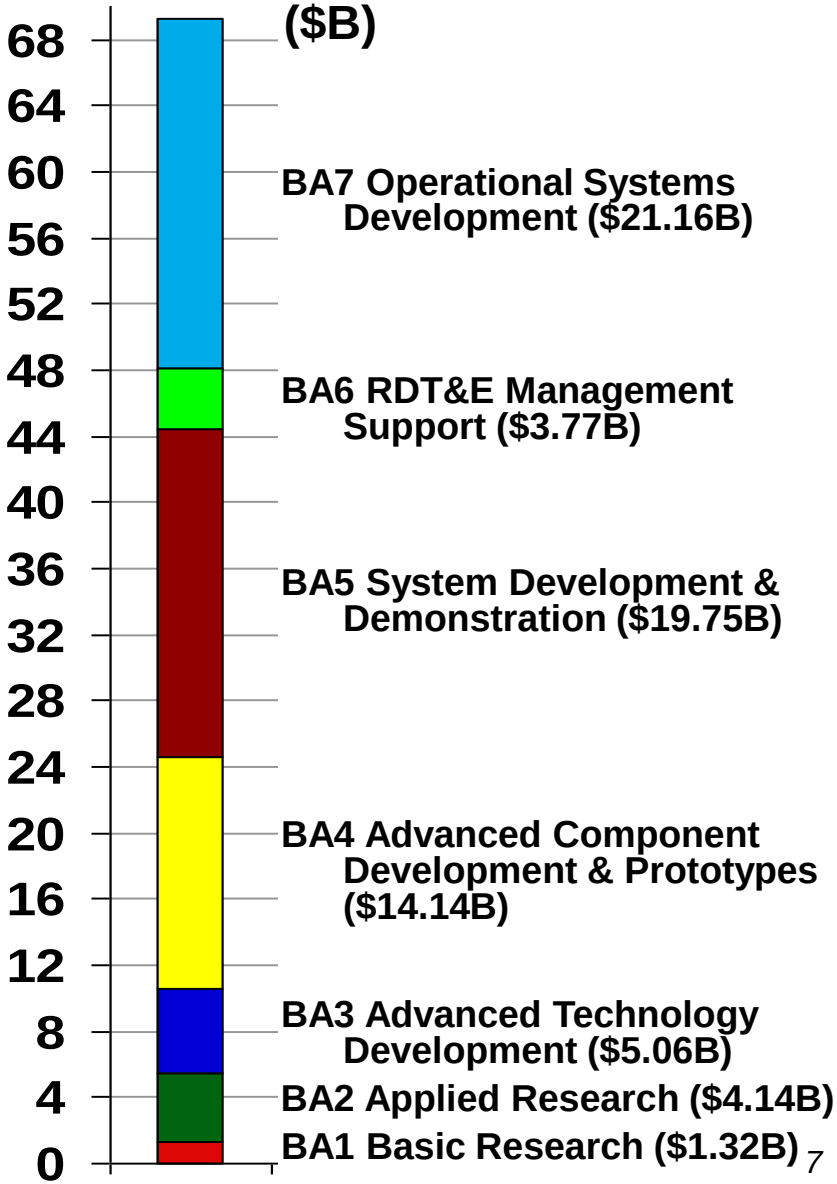
FY06 RDT&E request = $69.36B
(Budget Activities 1-7)

(BA6 + BA7 = $24.93B)

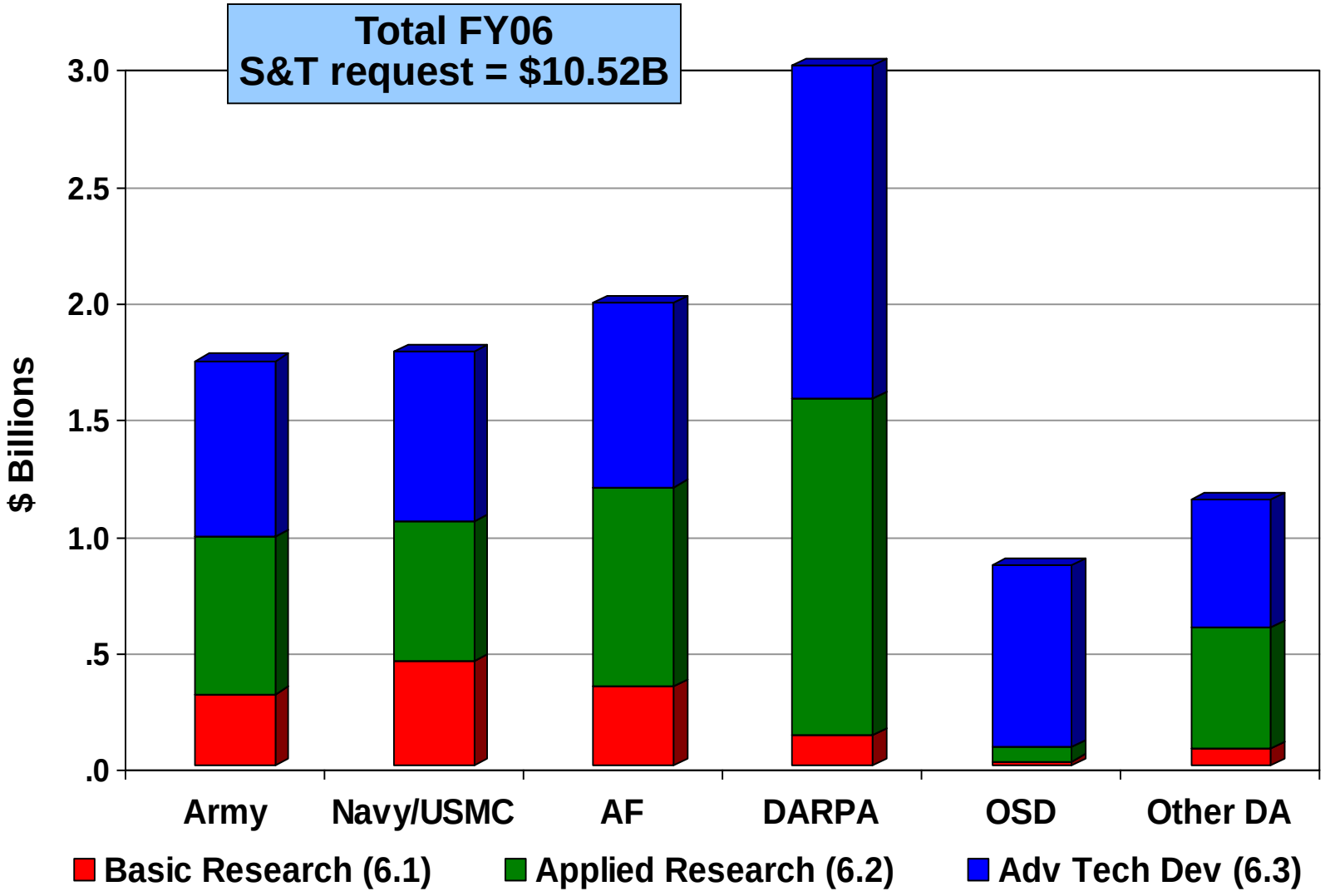
Development
(BA4 + BA5 = $33.89B)

Science and Technology
(BA1 + BA2 + BA3 = $10.52B)

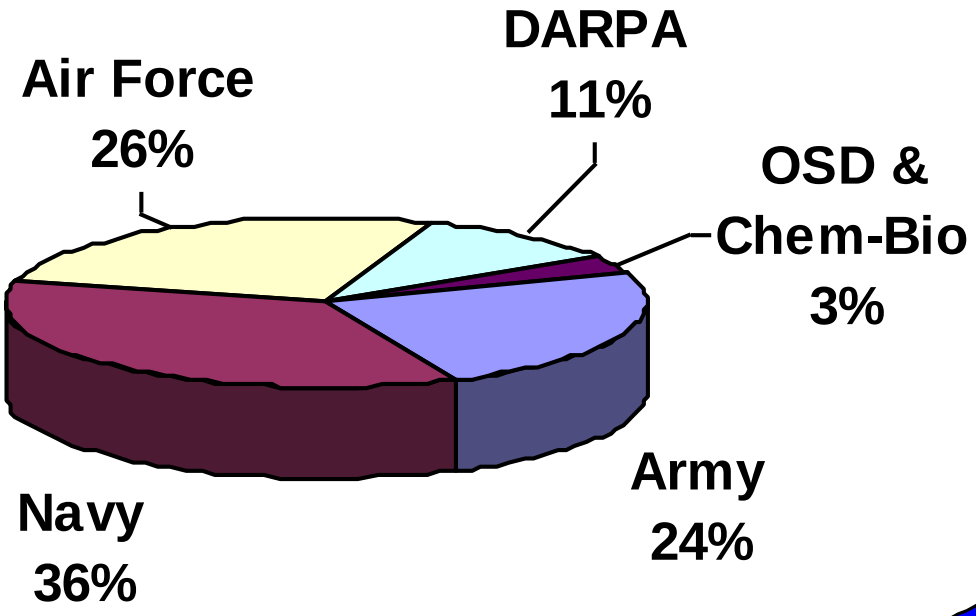
15% of RDT&E



FY06 DoD S&T Budget Request

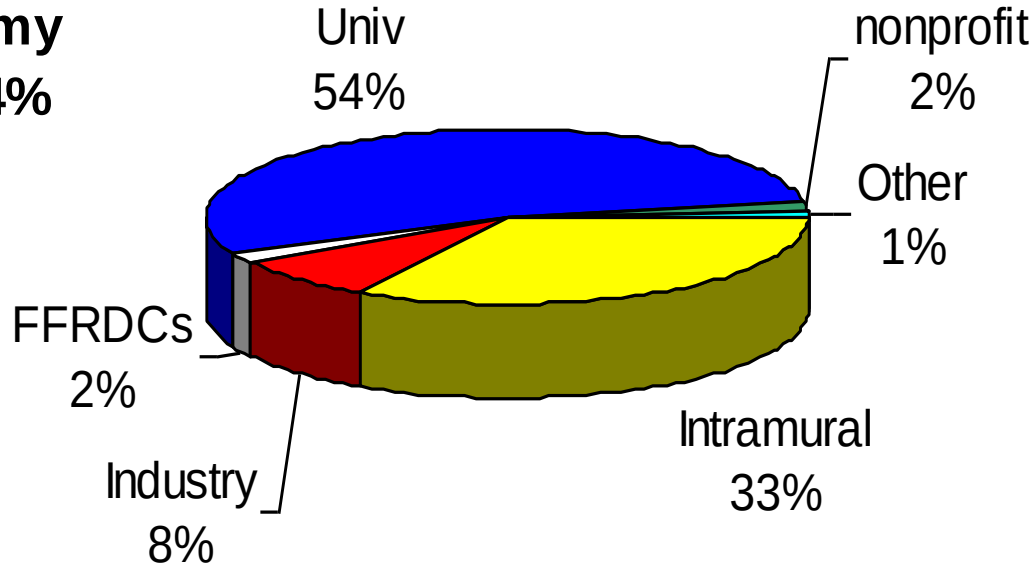


Source & Destination of Defense Basic Research Funding



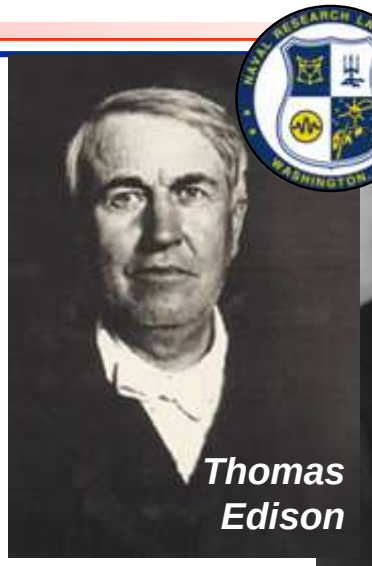
←Source 86% of Defense Basic Research ($1.33B) is from Investments by Military Departments

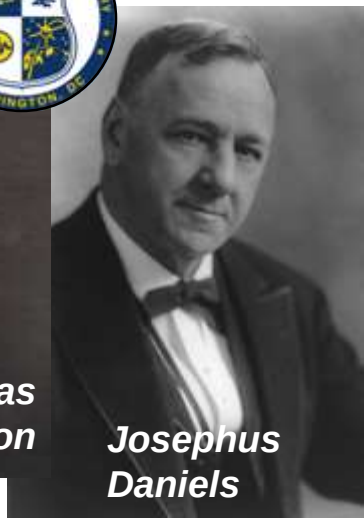
Destination→
Performers of Defense Basic Research



Naval Research: Statutory Mission

Naval Research Laboratory *(Appropriations Act, 1916)*:
"[Conduct] exploratory and research work…necessary… for the benefit of Government service, including the construction, equipment, and operation of a laboratory…."





Office of Naval Research *(Public Law 588, 1946)*:
"… plan, foster, and encourage scientific research in recognition of its paramount importance as related to the maintenance of future naval power, and the preservation of national security…. "





Transitioning S&T *(Defense Authorization Act, 2001)*:
"…manage the Navy's basic, applied, and advanced research to foster transition from science and technology to higher levels of research, development, test, and evaluation."

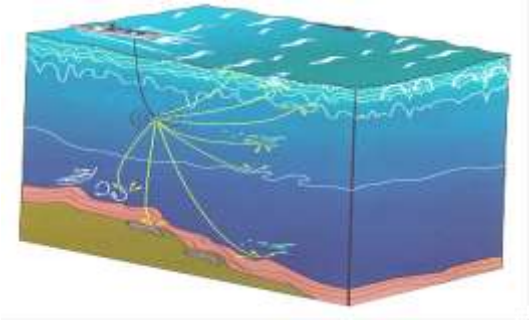


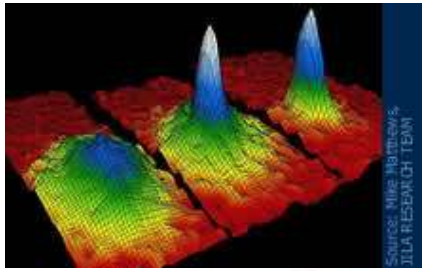
National Naval Responsibilities

- Naval environment is distinctive and complex
- Naval science and technology must maintain areas critical to ensuring Naval superiority:
  - –Robust U.S. research community
  - –Adequate pipeline of new scientists and engineers in Naval-unique disciplines
  - –Ensured future S&T products to Naval forces
- National Naval Responsibilities:

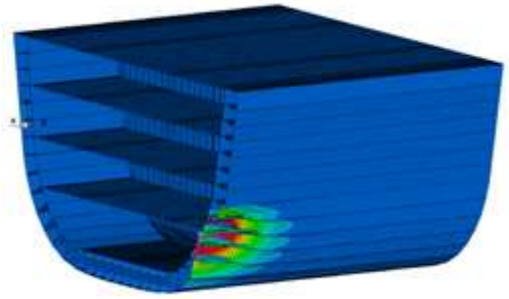
– Ocean Acoustics
– Underwater Weaponry
– Naval Engineering

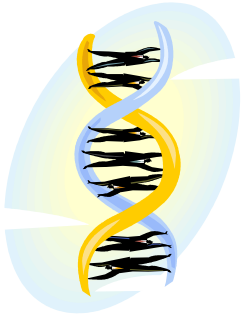
– Undersea Medicine (consideration)







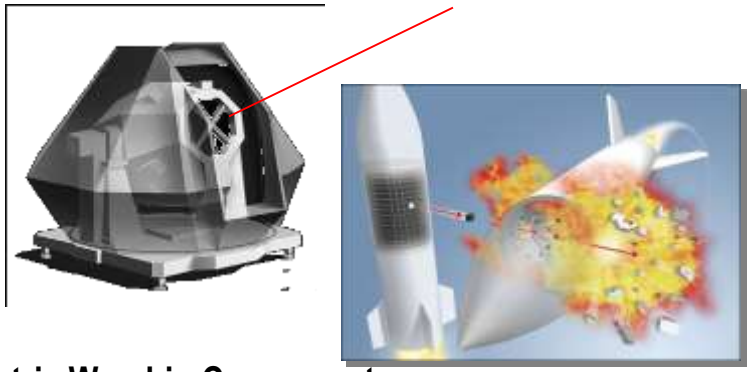




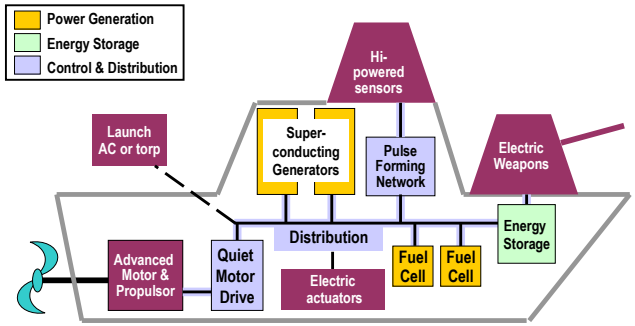
ONR Focus Areas

- **Global War on Terror**
  - *Emphasis on Counter IED*
- **Directed Energy Weapons**
  - *Free Electron Laser & Rail Gun*
- **Advanced Energetics**
  - *Increased Energy Density*
- **Energy and Power**
  - *Enabling the All Electric Warship*





Electric Warship Components



Countering the IED Threat
6.1 Basic Research for Long Term Solutions

- Strategy
  - Long term basic and applied research addressing foundations of current and future IED problem
  - Systems approach attacking each step in the engagement
  - Focus on Detect, Defeat, Destroy
  - Exploit sensor, chemistry/materials, and EW expertise
- Approach
  - A sustained investment
    - focused counter-IED research program -“manhattan-like project”
    - detection of threat & advanced long range destruction technologies





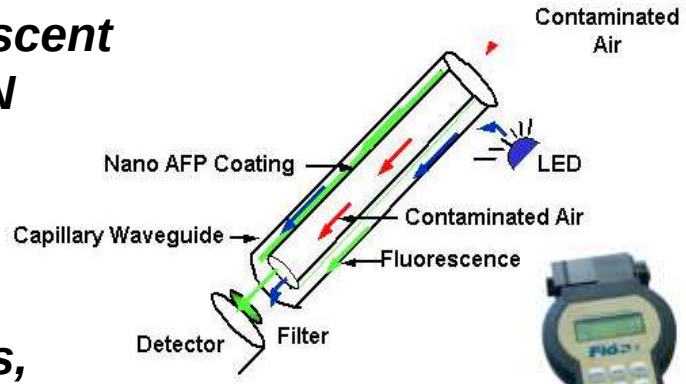


Proposal Processes -- Army 6.1 Program

- ***University Single Investigators***
  - *Grants to extend boundaries of fundamental knowledge*
  - *Annual BAA, peer review process; 2-3 year cycle per grant; ~ 100k/grant*
- ***University Centers***
  - *University-lead, focused initiatives*
  - *Competitive Contract; 3-5 year duration; $1-2M/year efforts*
- ***Collaborative Technology Alliances***
  - *Industry-led partnership with Army laboratories and academia*
  - *Competitive Cooperative Agreements; 5-8 year duration; $5- 8M/year efforts*
- ***Paradigm Shifting Transformational Centers***
  - *OSD approved University Affiliated Research Centers (UARCs)*
  - *Sole Source or Competitive Contract; 5-8 year duration; $5-10M/year efforts*
- ***Army Unique Laboratory Research***
  - *ILIR-Lab Director funds promising research; HQDA level peer review*
  - *ARI, COE, and MRMC – Annual BAA, peer review process*
  - *ARL, COE and MRMC – Internal process for program selection & focus; Periodic peer review of program quality*

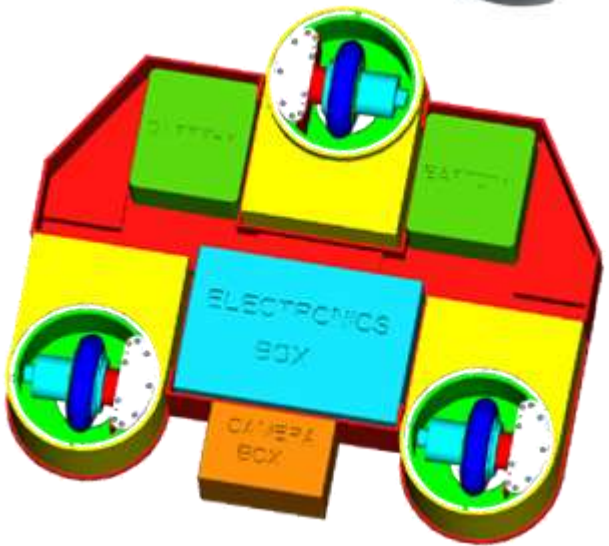
Detection/Inspection of Truck Bombs and Improvised Explosive Devices (IEDs)

- ***The Science: Amplifying Fluorescent Polymer (AFP) developed by ISN normally glows green, but quenches when TNT is present***
- ***The Detection Opportunity: Explosives leave invisible traces, which generate vapors that the AFP in Fido can sniff and detect***
- ***ODIS is a developmental robotic platform for on-road and off-road inspection at vehicle check-points or anywhere high maneuverability is required***
- ***Fido sensor is being integrated onto ODIS platform to provide unique capability to inspect for and detect truck bombs and IEDs both on- and off-road***



Fido

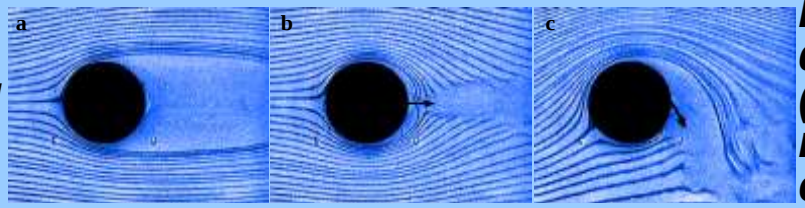




ODIS

Micro Active Flow Control

Small-scale blowing of jets of air at precisely the right spatial and temporal locations can control large scale flow-fields



Impact: aerodynamic drag (b) & lift forces (c) can be significantly modified by small energy inputs

- ***Applications: guided munitions, enhanced performance VTOL aircraft, turbine engine surge and stall control***
- ***Concept developed in research originally performed at U of Arizona, Tel Aviv U, Georgia Tech***
- ***Program management/funding by ARO and DARPA***

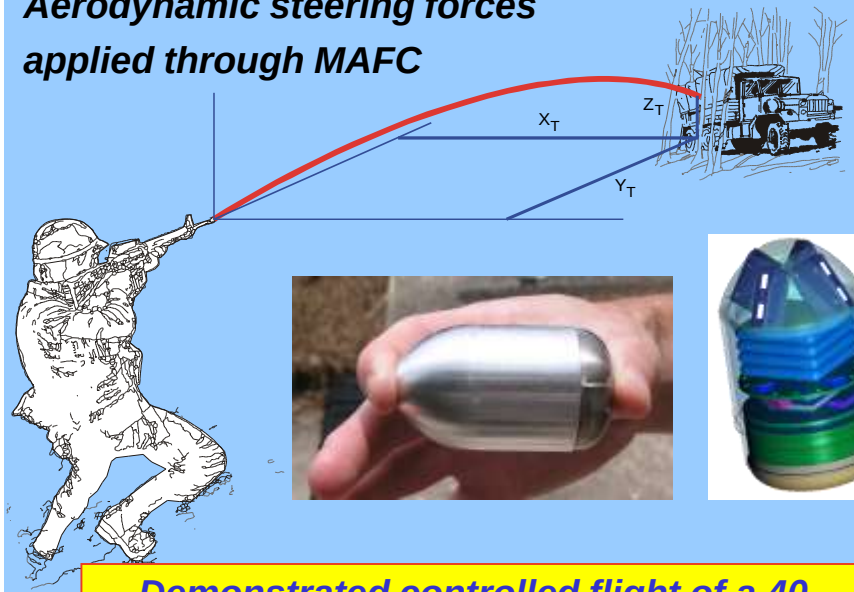
Tiltrotor Download Alleviation



Demonstrated 10% net download alleviation, which would yield a significantly enhanced payload (1000 lbs) or mission range (77% increase) for the V-22

SCORPION – (Self Correcting Projectile for Infantry Operation)

Aerodynamic steering forces applied through MAFC



Demonstrated controlled flight of a 40 mm projectile with steering forces sufficient to compensate for muzzle velocity dispersion

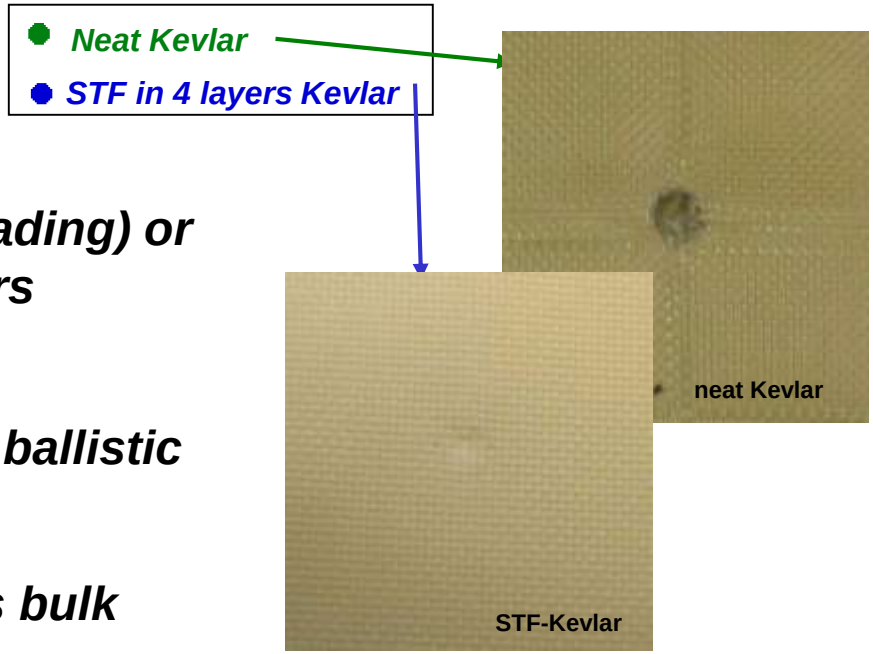
"Liquid Armor" Concept

Objective: Provide a compact, flexible armor material

- ***Shear thickening fluids (STFs):*** ***Materials (nanoparticles of silica suspended in polyethylene glycol) which are flowable at low deformation rates but solid-like at high deformation rates (nanoparticles compress into rigid mass)***
- ***Adding STFs to ballistic fabrics such as woven Kevlar can dramatically improve their protective properties, including:***
  - ***Puncture resistance***
  - ***Ballistic resistance***

STF-Kevlar vs. Neat Kevlar:

- ***Reduced aerial density (high fabric loading) or greatly reduced number of fabric layers (high STF loading)***
- ***Fewer layers required for comparable ballistic properties***
- ***Significantly higher flexibility and less bulk***
- ***Potentially less expensive***

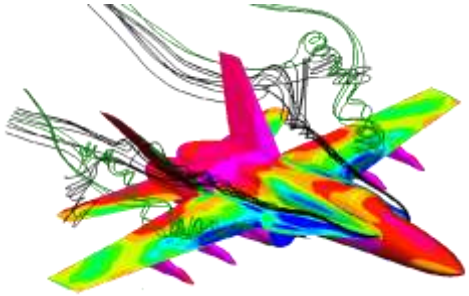


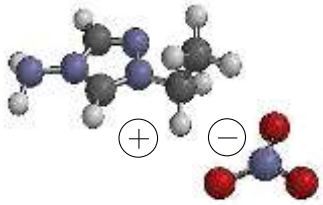
Comparison of neat Kevlar and STF-Kevlar after ballistic impact

Air Force Office of Scientific Research (AFOSR)

- **Single Manager for Basic Research Addressing Air Force Needs**
  - **Component of the Air Force Research Laboratory (AFRL)**

- **Physics**
- **Solid Mechanics and Structures**
- **Chemistry**
- **Mathematics and Computing Sciences**
- **Electronics**
- **Fluid Mechanics**
- **Propulsion**
- **Space and Information Sciences**
- **Biological Sciences**
- **Human Performance**





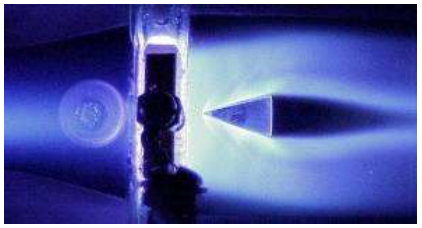

Creating Revolutionary Scientific Breakthroughs for the Air Force

AFOSR Funding
(FY2004)

- **Air Force Core Basic Research Program ($205M)**
  - **Over 800 Grants to Over 180 Universities (~60%)**
  - **AFRL and Other Air Force Organizations (~30%)**
  - **Industry and Others (~10%)**
- **University Research Initiatives ($104M)**
  - **Multidisciplinary University Research Initiatives**
  - **Defense University Research Instrumentation Program**
  - **National Defense Scientists & Engineers Fellowships**
- **Other Agency Funds (~$85M)**
  - **DARPA**
  - **Small Business Technology Transfer (STTR) Program**
  - **Others**

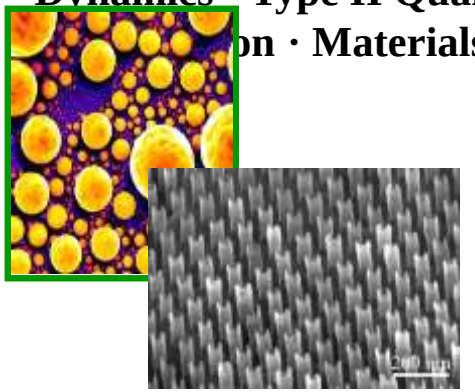
AFOR is the Sole Manger of Air Force Basic Research

AFOSR Emphasis Areas



Themes **Cooperative Control · Plasma Dynamics· Miniaturization Science · Biologically Inspired Concepts · Plasma Dynamics · Type II Quantum**
on · Materials Engineering





Nanotechnology **Multispectral Detector Arrays · Chip Scale Optical Networks · Compact Power for Space · Nanoenergetics · Nanomaterials for Structures**

Information Dominance **Human Decision Making · Adversarial Modeling· Information Assurance · Information Fusion · Information Operations · Command & Control Infosphere · Transformational Communications**





Polynitrogen Chemistry

New rocket fuel?

Polynitrogen compounds could pack double the punch of existing space propellants.



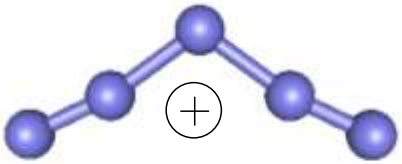
Revolutionary synthesis of the N_5^+ cation and production of polymeric nitrogen have opened up new field of polynitrogen compounds for all-nitrogen propellants.

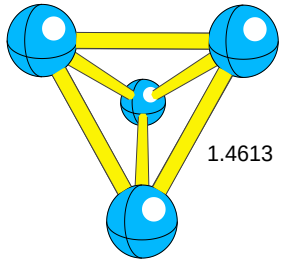
Advantages

- Substantially reduce cost of space delivery
- Major safety improvements
- Environmentally benign/reduced signature

Applications

- Space lift - (main boosters)
- Upper stage rocket propulsion
- Satellite propulsion





Biologically Inspired Guidance & Control

NextFrontiers

INVENTING THE FUTURE

Even the most important new ideas can seem silly at first, or irrelevant or downright dangerous. (You mean that thing can fly?) How do you tell which ones are worthy? The best way is to just give them a try. Ten innovations that may change the way we live.

1

Ten innovations that may change the way we live.

BY MICHAEL HASTINGS

BRYANT LINARES has one heck of a secret family recipe: how to make world-class diamonds. Seven years ago his father, Robert, produced a diamond in a high-pressure chamber with carbon gas and dropped it into an acid solution to clean it off. When he returned the next morning, he expected to find the usual yellow stone—an artificial diamond of some industry, perhaps, but not the stuff of dreams. At first the didn't seem to be any stone. Then he saw, at the bottom of the beaker, so clear it was almost invisible, a perfect quarter-carat crystal of pure carbon. "It was the eureka moment," says Bryant. His father had managed what many scientists had given

Man-made diamonds are nothing new—industry started making them in the 1950s, and each year about 80 tons of flawless, though, open up huge possibilities, jewelry being the least of them. Scientists are most excited about the prospect of making ways of dissipating the heat they create. Because silicon, the main component of semiconductors, breaks down at about

60 NEWSWEEK OCTOBER 25, 2004

2

What A Fly Knows

BY JERRY ADLER

SOMETIMES, [illegible] Michael Dickinson will set a wineglass of vinegar or whisky down on the edge of his lectern. Dickinson, a professor of bioengineering at Caltech, is one of the world's experts on the flight mechanics of fruit flies. He has spent years fitting them with tiny harnesses, rotating them in a virtual-reality chamber, filming their wings with ultrahigh-speed cameras to catch them as they change direction in one fifth the duration of an eye blink. He has modeled their aerodynamics with an oversize robot fly whose wings flap mechani-



FLIGHT SIMULATOR: Fruit fly (inset) tracks odors in Dickinson's virtual-reality chamber

As he [illegible] carbon dioxide. Could we build such devices, and make them cheap and robust enough to cover a large territory? In part, [illegible] a software problem: [illegible] a search in the [illegible] and unpredictable obstacles. Insects solve it with a brain—in the case of fruit flies—the size of a poppy seed, containing perhaps 300,000 neurons. The average human has 100 billion.

To investigate how they do it, Dickinson has built a miniature fly world, a cylindrical cage about a meter across and high, with varying obstacles and background patterns projected on the walls, and electronic cameras recording the fly's movement at speeds up to 6,000 frames per second. The fly's task is to find an odor source on the floor of the apparatus. "The animal wants to track the plume to its source. So the first thing it has to do is orient upwind. But the plume is snaking around, the fly may have to avoid a visual obstacle, so there's a good chance it will lose it. What does it do then?" Dickinson is in effect reverse-engineering a living creature, taking it apart to see how it was built and how it functions, with the goal of someday replicating at least part of its behavior. We are far from being able to build machines that can walk upside down or hover like an insect, at least on those size scales, he says. But it would be nice to be able to think like them. ■

Consider the problem of finding a lost hiker in the woods. Who will reach him first—the park police or the mosquitoes?

… suppose we could deploy a fleet of drone aircraft equipped like mosquitoes, with sensitive detectors …

Dickinson is in effect reverse engineering a living creature, taking it apart to see how it was built and how it functions, with the goal of someday replicating at least part of its behavior.

3

How to Program A Cell

BY CARL ZIMMER

A LOT OF TODAY'S engineers got their start as kids playing with electronics kits, wiring together resistors or capacitors. Depending on how you put the pieces together, you could build a simple switch or make bulbs blink like a movie marquee.

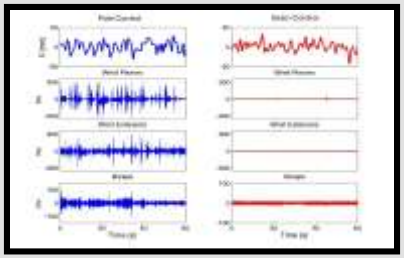


WIRED: Telling cells how to behave

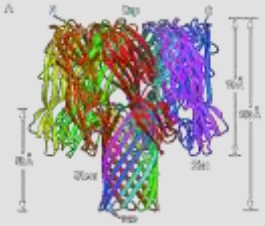
Basic Research in Biology BLS-01

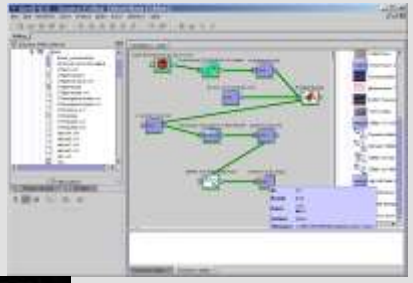
DEFENSE SCIENCES OFFICE

- **Human Assisted Neural Devices**
  - Understanding the Language of the Brain -- Enabling Technology for Revolutionizing Control of Prosthetics
- **Biological Adaptation, Assembly and Manufacture**
  - Exploit the unique response, adaptability and fault tolerance of biological systems
- **Nanostructure in Biology**
  - Apply advances in nanotechnology to understand and exploit the nanostructure features of biology
- **BioComputation**
  - Application of computation and design tools to understand biology of interest to DoD
- **Bio Interfaces**
  - Understand and Exploit the Intersection Biology with the Physical and Mathematical Sciences
- **Simulation of Bio-Molecular Microsystems**
  - Develop phenomenological models, scaling laws and design rules for Bio-Microdevices.

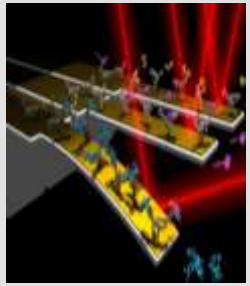








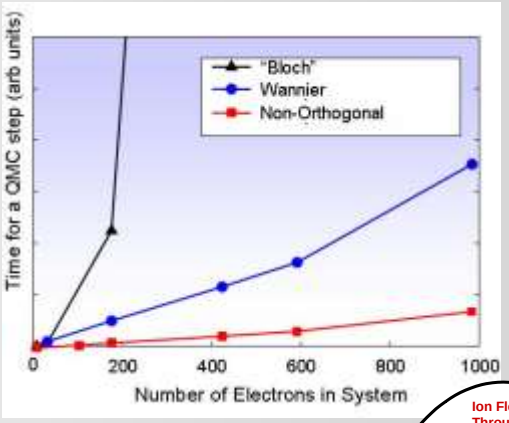


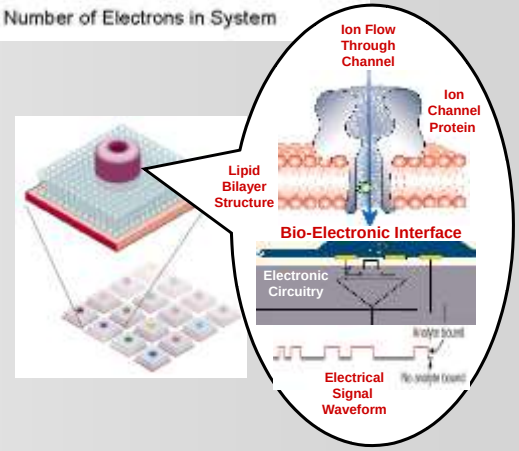


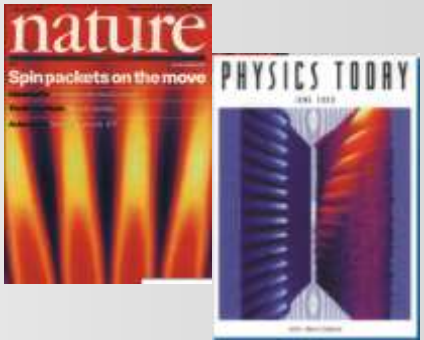
Basic Research in Biology BLS-01

DEFENSE SCIENCES OFFICE

- **Nanoscale/Bio-molecular and MetaMaterials**
  - Control of nanoscale and biological structure for materials and devices
- **Engineered Bio-molecular Nano-Devices and Microsystems**
  - Technologies to enable high speed transduction of biological signals into electrical signals
- **Spin Dependent Materials and Devices**
  - Use of electronic spin for ultrasecure, ultrafast electronic and communication devices



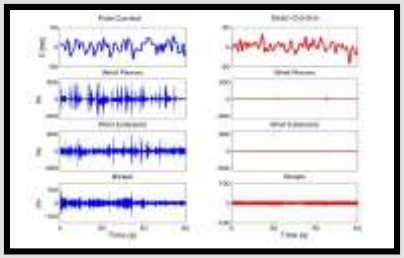




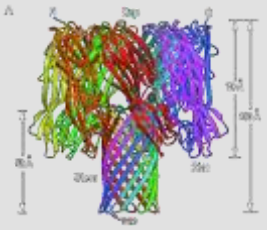
Basic Research in Biology BLS-01

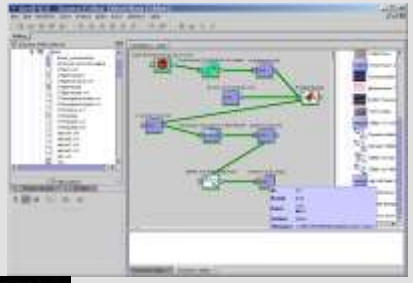
DEFENSE SCIENCES OFFICE

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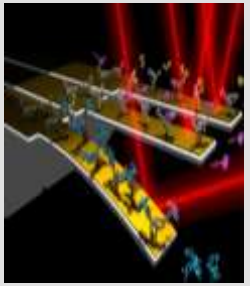








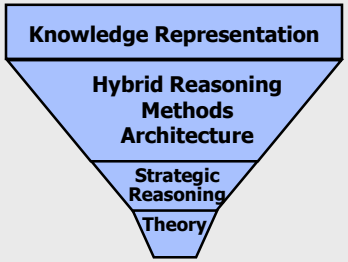


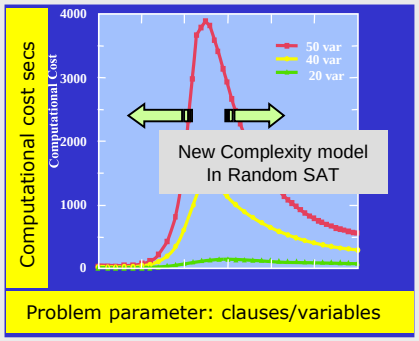


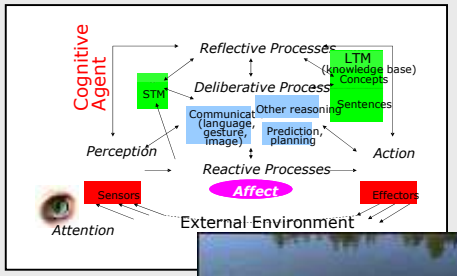
Computer Exploitation and Human Collaboration













Goal: develop information processing technologies to enable users to interact with computers in an intuitive fashion, and enable collaborations as well as intelligent exchange of information in a seamless manner

Technical Challenges

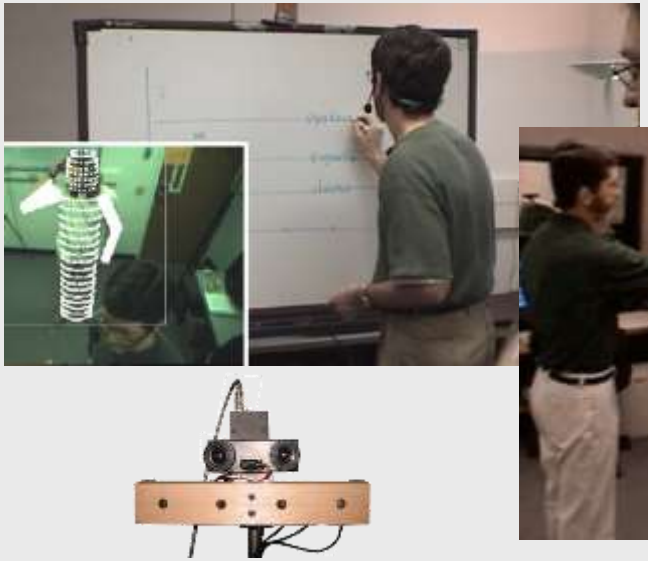
- Practical inferential "deep" reasoning within the complexity of the real world
- Integrated hybrid reasoning tools to aid in decision making within a multi-player context
- Episodic information learning from experience and the application of that information
- Natural communication modalities to maximize effectiveness of the human computer interface
- Selective filtering of salient information within the mission context

Technical Approach

- Develop dynamic hybrid reasoning architectures addressing complexity in propositional inference
- Use insights from mathematical game theory to develop tools for strategic reasoning
- Modify software and hardware based on human perceptual processing models and neuroscience resulting in the extraction of salient information and enhanced human performance
- Conduct experiments to understand natural multimodal communication patterns in military contexts and develop adaptive processing techniques well suited to natural communication settings

Performers: SRI International; UC Berkeley; Cornell Univ; Naval Health Research Center; NAWC AD; BMH Inc.; and Carnegie Mellon Univ

Computer Exploitation and Human Collaboration Accomplishments



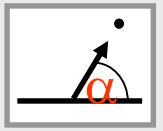
Multimodal Dialogue



- New algorithms developed to locate people in meeting room and track where they are looking



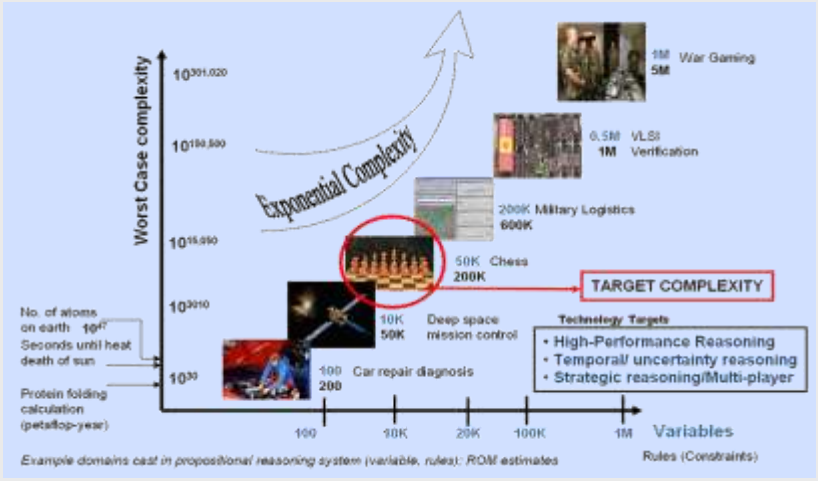
- New direction of arrival algorithms discovered for determining where sound is coming from



- New algorithms developed for associated audio with correct portion of video



Reasoning

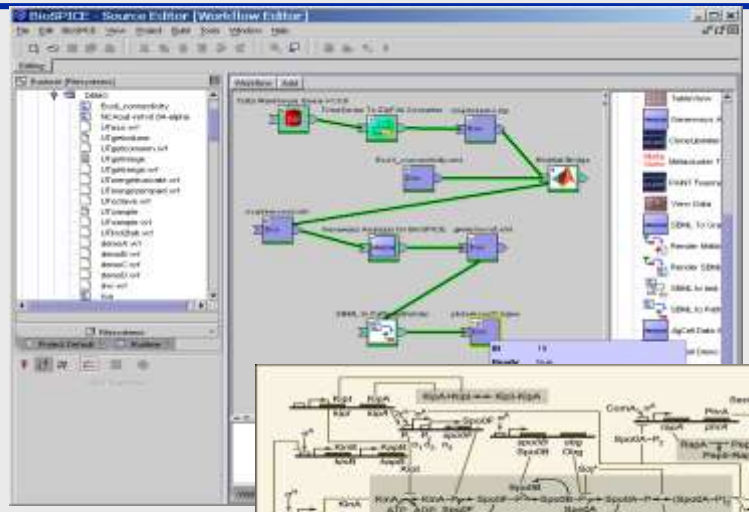


- Major step towards high-performance reasoning implemented: Developed new representations (Quantified Boolean Formulae) that speed up inference by 5 orders of magnitude
- Temporal reasoning under uncertainty: Implemented exact and approximate dynamic Bayesian networks that can scale to 1K-variable partially observed systems. Demonstrated Kriegspiel chess challenge problems (Program target 80% solution for problems with $10^{3,010}$ cases)
- Defined and implemented multi-agent reasoning in multi-player environments: Developed algorithms based on game theory for a variety of game reasoning scenarios

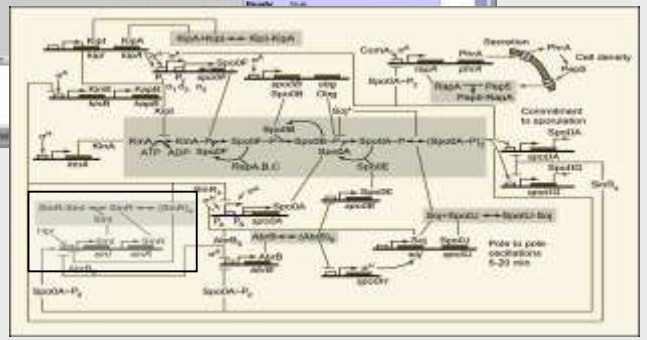
BioComputational Systems

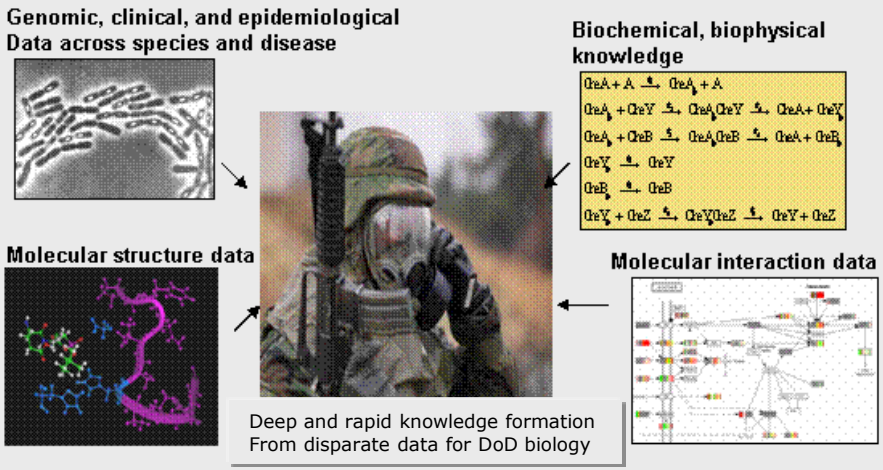
Application of computation and design tools to understand biology of interest to DoD

- **Computational modeling of biology**
  - Understanding pathogen/host interactions
  - Predicting early markers of disease
  - Understanding of emerging threats
- **Bio-SPICE computational tools**
  - Tools for modeling and analysis
    - Behavior of complex spatio-temporal networks
  - Tools for fast, robust simulation of hundreds of Intra-Cell Processes
- **Extensive model of sporulation developed for *Bacillus subtilis***
- **New molecular controls for cell division identified and validated**
  - Potential new methods for wound healing, nerve regeneration, and bacterial growth control
- **Preliminary model developed for pathways (apoptosis) triggered by bio-agents**
  - Collaboration with Walter Reed Army Medical Research) to identify markers for early detection
- **Plans: Extend models to support complex behavior of tissue, organs, and systems biology**
- **Develop scalable and fast methods for knowledge formation, extraction, and modeling**



Bio-SPICE dashboard supports an extensible architecture



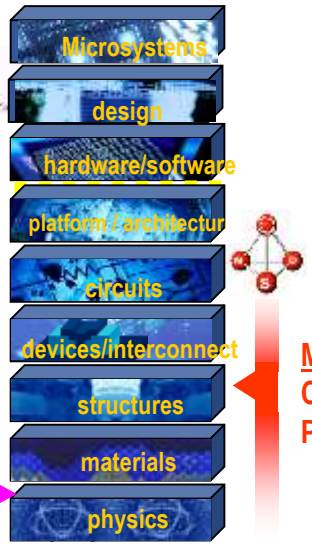


Microsystems Technology Office
Basic Research

GSRC- Centered on Systems:
- Hetero Design
- Soft Systems

C2S2 - Mostly Circuits:
- Analog/Mixed Signal
- Heterogeneous Circuits
- Post-CMOS circuits

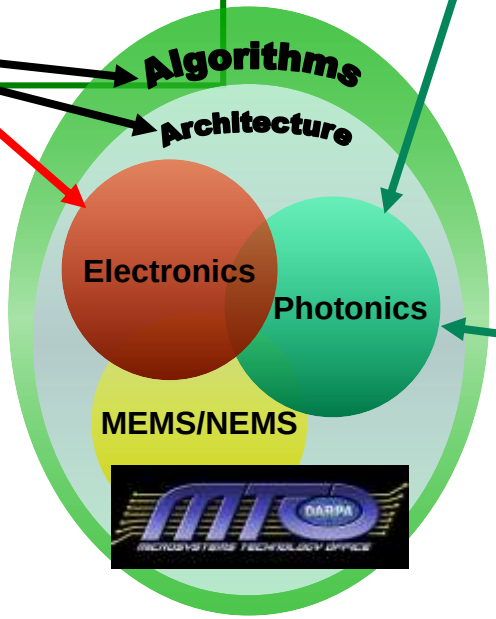
FENA - Post-CMOS Research in Nano materials /devices.



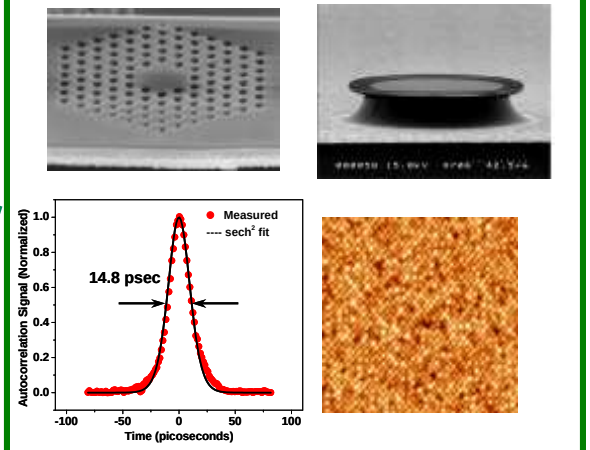
IFC - Nano wires; Expanded Opto-electronics, Power.

MSD – Ultimate-scale CMOS structures; Post-CMOS Materials

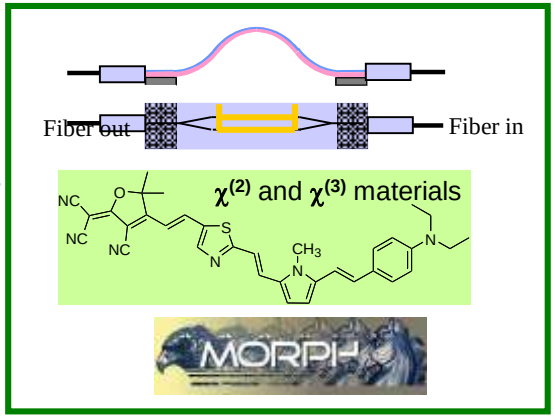
Focused Research Center Program



Spatial, Temporal, and Spectral Confinement of Photons and Electrons



University Photonics Research Centers



Super Molecular Photonics Research

Defense Basic Research

- Fundamental, long-term
- Multifaceted
- Broad Based and Strategic
- "Effective" in
  - Generating new knowledge
  - Training new Scientists/Engineers
  - Sustaining research infrastructure
- Enables novel technical options/capabilities

End

- Dr. William O. (Bill) Berry
- (703) 692-4592
- William.berry@osd.mil
- http://www.dod.mil/ddre/mainpage.htm

AFRL – Towards the Next Horizon



Dr William U. Borger
Director, Plans and Programs
Air Force Research Laboratory

Agenda

- AFRL – Who We Are
- S&T Budget
- Principles and Vision
- S&T Program Drivers
- Future Directions

Air Force Research Laboratory Technology Directorates

Commander (CC)

Executive Director (CD)

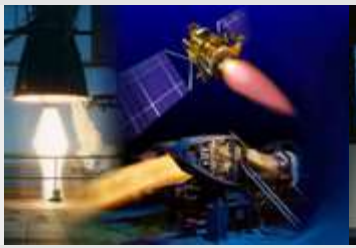
Vice Commander (CV)

Chief Technologist (CT)

Staff

Plans and Programs (XP)

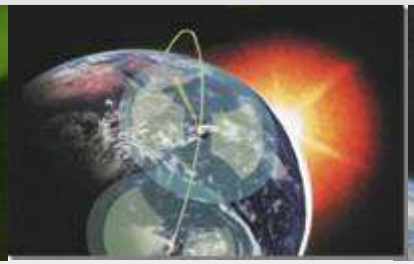
Propulsion & Power | Information | Munitions | Air Vehicles | Space Vehicles







Directed Energy | Sensors | Human Effectiveness | Materials & Mfg | AFOSR

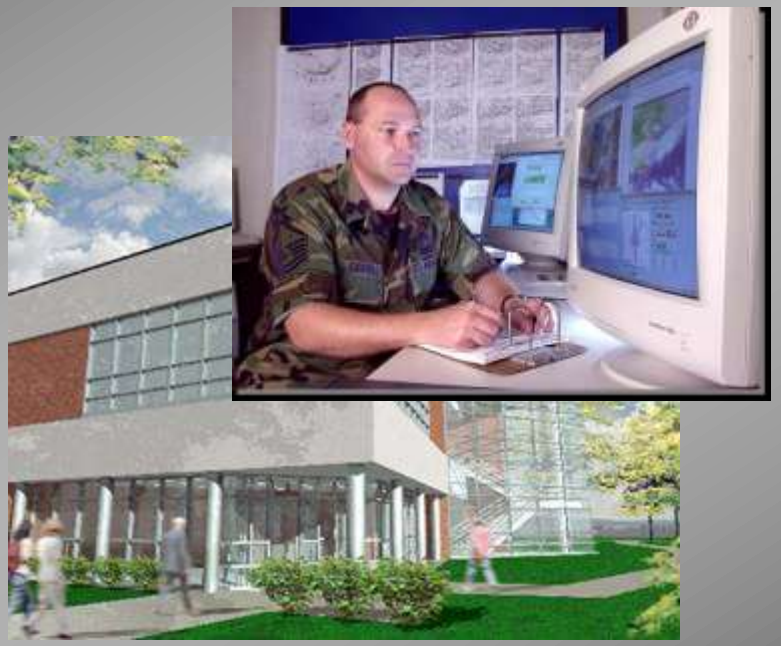







AFRL People & Facilities

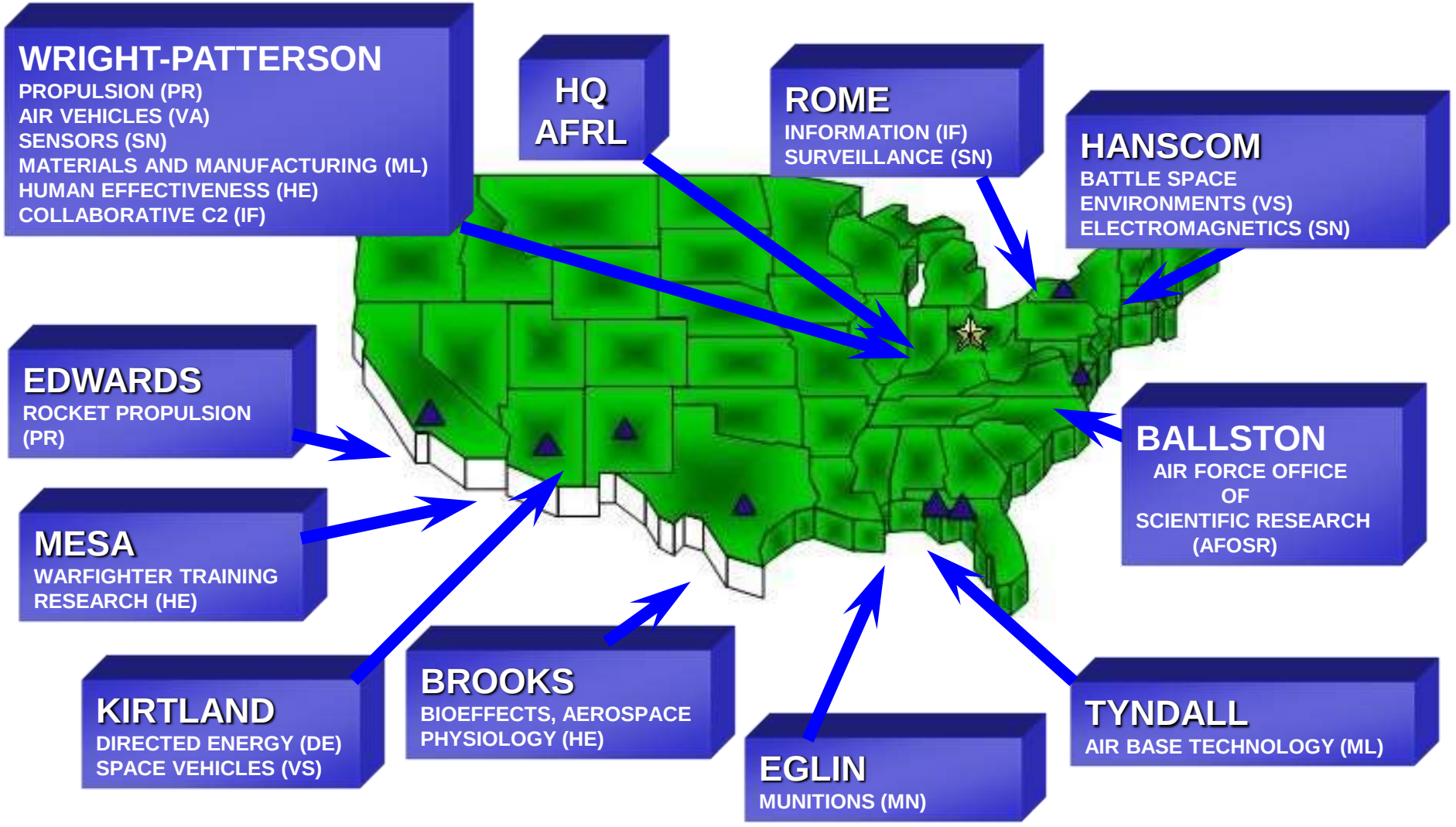




- 5343 Government Employees
- 3798 Onsite Contractors

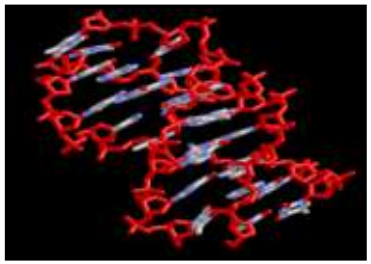
- 10 Major R&D Sites across US
- Real Property Replacement Value = $1.8B
- Equipment Property Replacement Value = $1.7B

AFRL Major Sites



Technology for the Air Force "Concept to Combat"

6.1 Basic Research
(e.g., Bio Sciences)

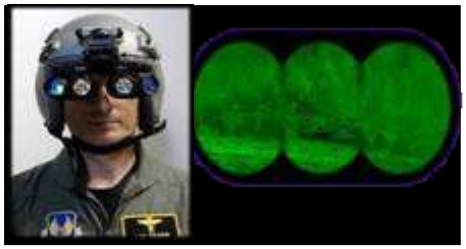


6.2 Applied Research
(e.g., Joined-Wing)



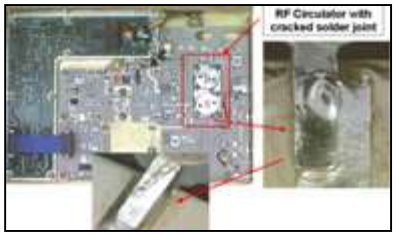
6.3 Adv Tech Demos
(e.g., Night Vision Device Training)





7.8 Man Tech
(e.g., PNVG – 2nd Source for Intensifier Tubes)

Full Spectrum Science and Technology



Quick Reaction
(e.g., C-17 SKE Failure)



User Needs
(e.g., Aging Wiring Integrity)



Future Concepts
(e.g., Unitized/ Modular Structures)



Acquisition Consulting
(e.g., Boom Operator Weapon System Trainer)

Agenda

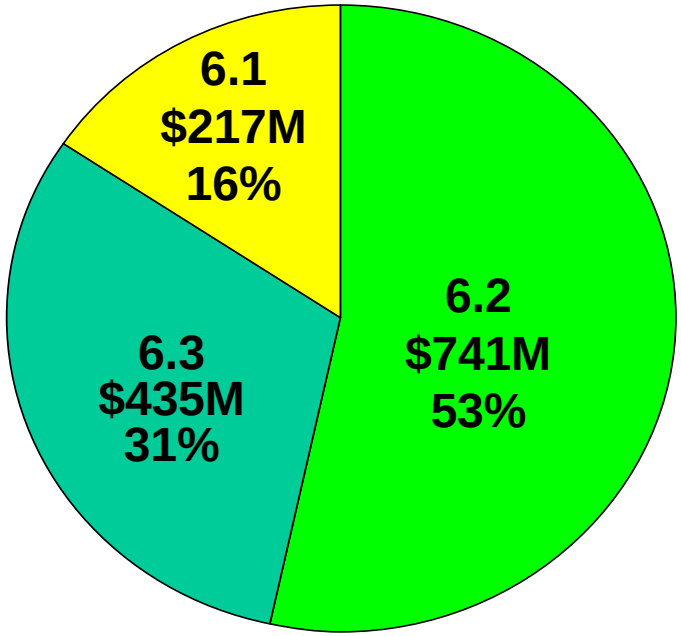
- AFRL – Who We Are
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Strategic Planning Guidance – Background

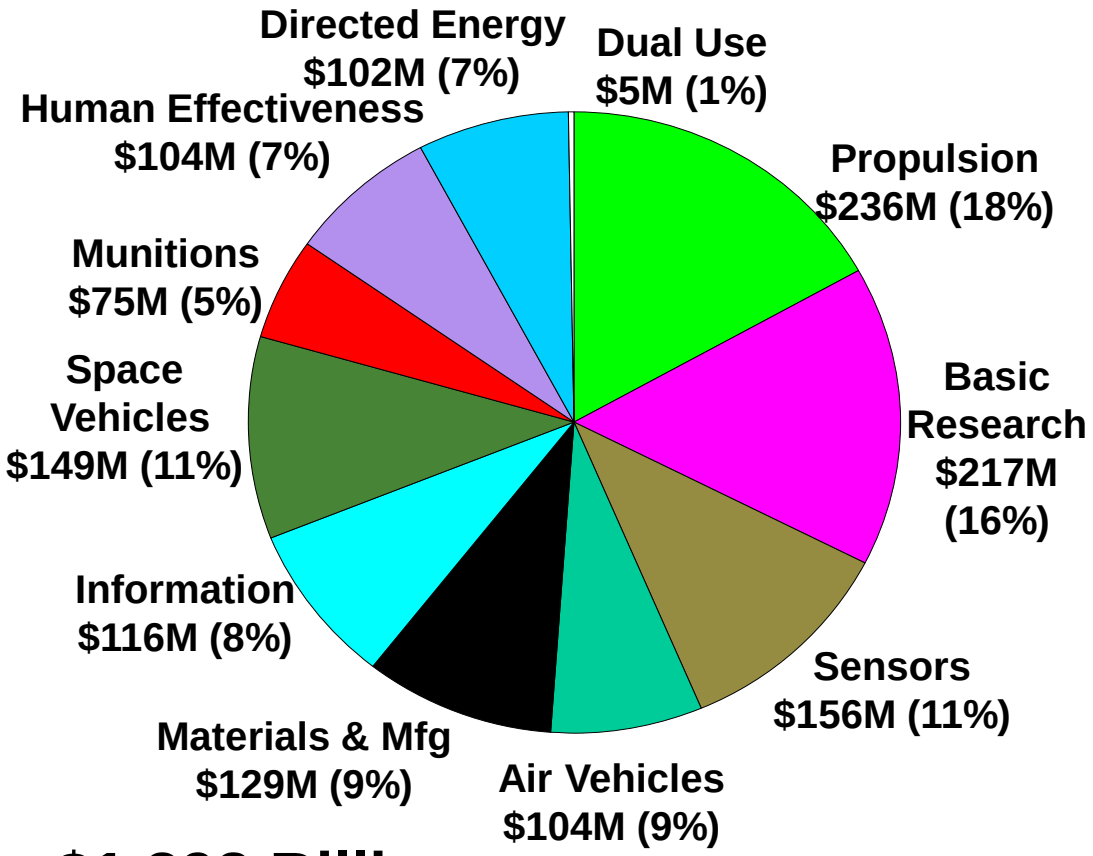
- **SPG Direction**
  - **"(U) Components will maintain or increase S&T investment at the levels programmed in the FY 2005-2009 President's Budget FYDP for FY 2006-2009, with the goal of achieving 3 percent annual real growth."**

FY05 President's Budget
AF S&T Budget

By Budget Activity



By Directorate/Tech Area

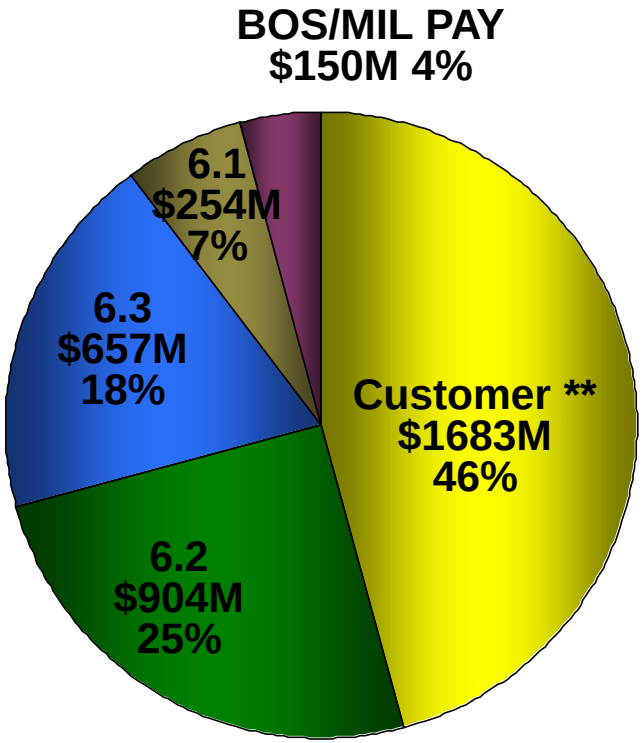


TOTAL: $1.393 Billion

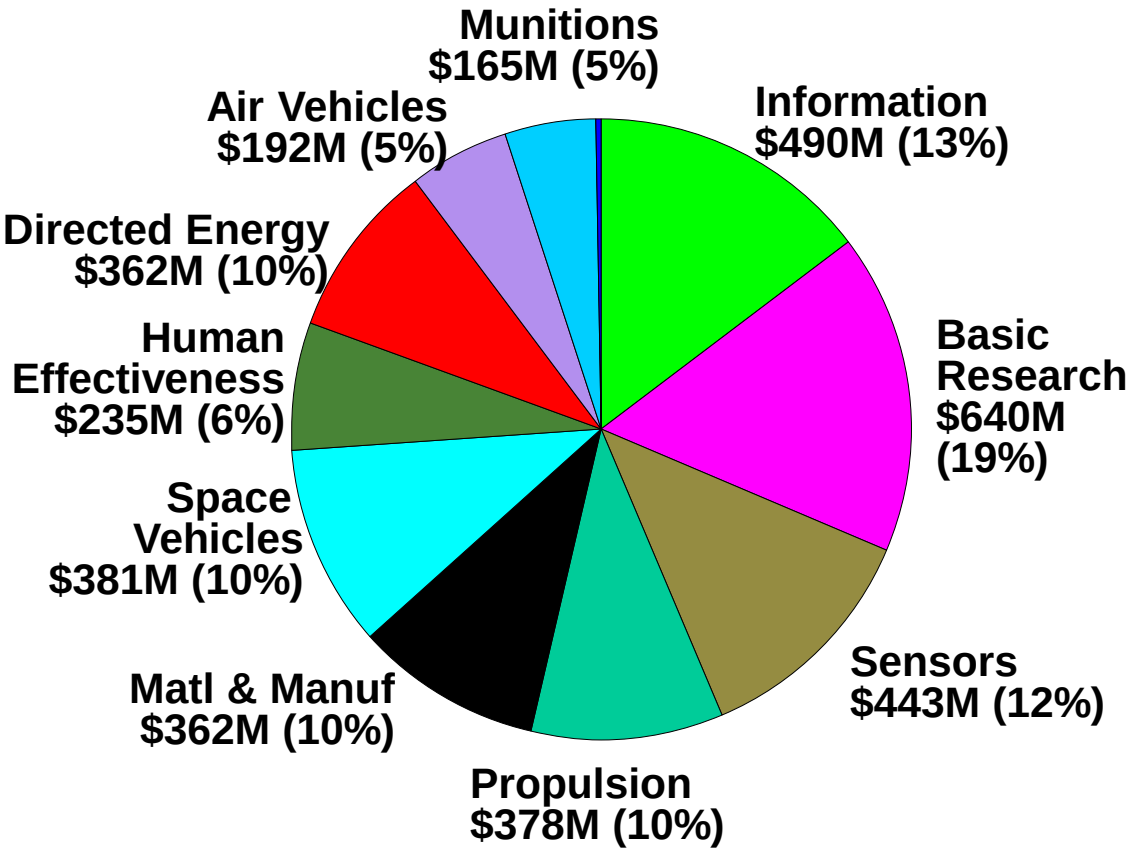
Values May Not Add Due to Rounding

FY05 Total AFRL Budget

By Budget Activity



By Directorate/Tech Area



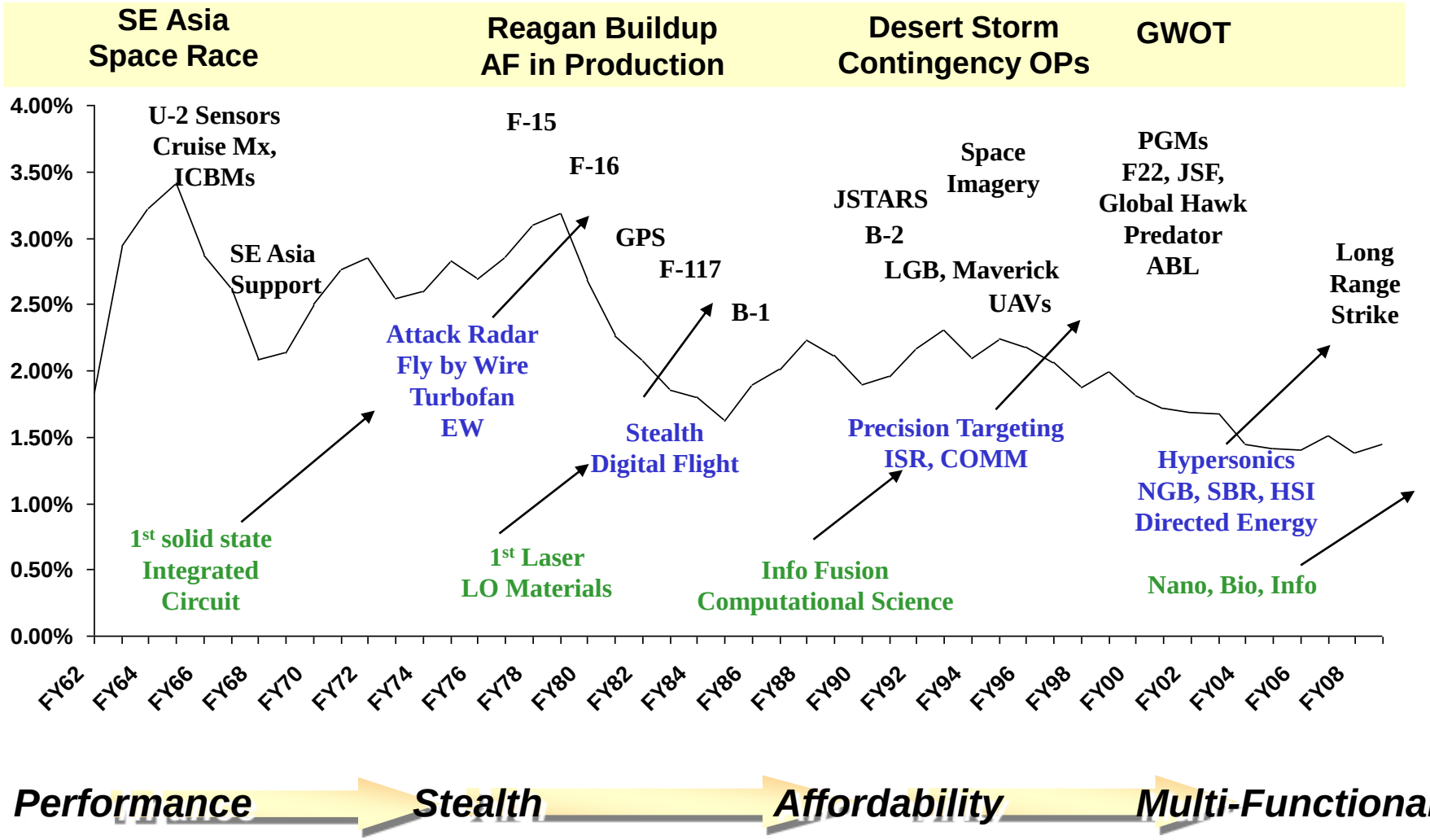
- Values May Not Add Due to Rounding
- ** Includes SBIR

TOTAL: $3.648 Billion*

As of 29 Nov 04

AF S&T AS % OF AF BLUE TOA*

FY62 THROUGH FY09



Performance → **Stealth** → **Affordability** → **Multi-Functional**

* AF BLUE TOA excludes National Foreign Intelligence Program (NFIP), Defense Health Program (DHP), and Special Operations Command (SOCOM)

Operating Tenets

- Outsource majority of research/tech development to industry and academia
- Perform focused in-house research to maintain core expertise and be a smart outsourcer
- Balance near term transfer and far term research
- Collaborate/coordinate with others
  - DoD: Army, Navy, DARPA, DTRA, MDA, NRO
  - Other federal agencies: NASA, DOE, others
  - Private sector
  - International

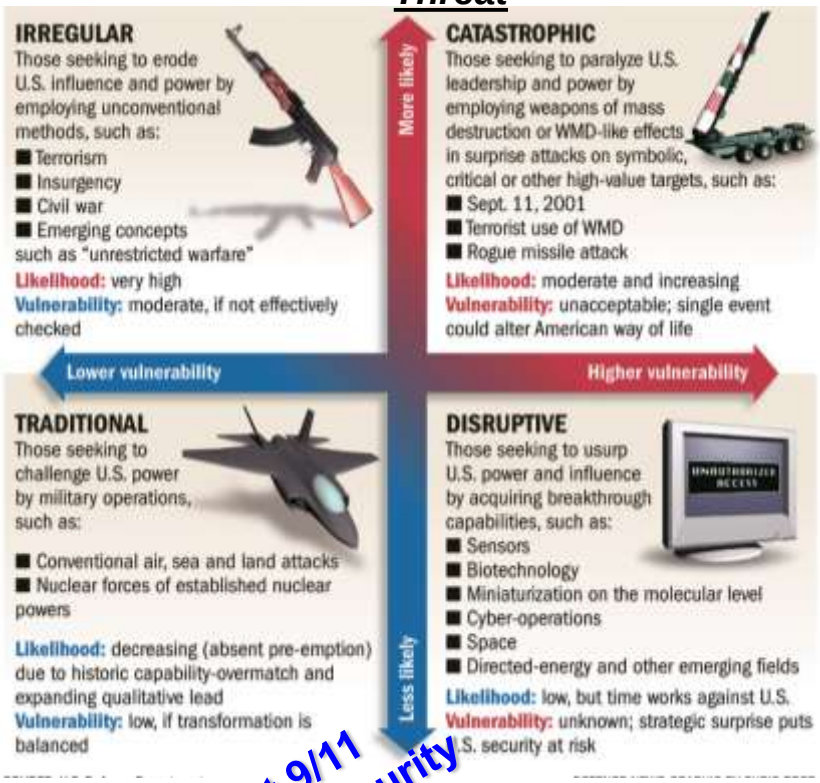
Agenda

- AFRL – Who We Are
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- Future Directions

Many Changes in Global Realities Since the Creation of AFRL

The speed of modern technology and the creativity of our elusive and opportunistic adversaries makes "what we don't know" highly dangerous

Threat



Technology

What we don't know we know ***(missed opportunities)***	***What we don't know we don't know*** ***(most dangerous)***
What we know we know	***What we know we don't know***

Post 9/11 National Security New Challenges

"Global Situational Awareness"

"Speed & Agility"

"One out of a Million" Threat Environment

Cyber / Info Ops Gap

Lean Defense Budgets

The World Has Changed…

In An Environment of Change AFRL Must Have a Clear Site Picture of What Our Customers Need

Who are Our Customers and What Do They Want?

- **AF Senior Leadership**
  - Technology ideas that shape future concepts
  - Tech push to show operators what's possible
- **Program Managers (Capability Developers)**
  - Transitionable technology options
  - Core S&T connected to operational AF needs via CRRA "requirements pull"
- **Capability Users and Decision Makers**
  - Responsive technology solutions
  - Unprecedented innovation to meet urgent needs

Three discrete:

- **Customers**
- **Timelines**
- **Outputs**
- **Relationships**

Today's Lab has one work structure to serve all customers

Attributes of the Envisioned Future
oneAFRL

- **Consistently anticipate and proactively adapt to an uncertain future**
- **A valued AF team member – *leading innovative, integrated, and multidisciplinary*:**
  - **Long-term research, driven by an audacious technology goal – *shape the future Air Force***
  - **Development of technology options that meet the needs of capability developers – *deliver on our commitments***
  - **Technology response to urgent needs – *provide rapid, come-as-you-are solutions***
- **Grow technology leaders for the AF**
- **Access and exploit all of mankind's S&T knowledge**
- **Establish and fully leverage strategic partnerships**
- **Operate with sound enterprise business principles**

Agenda

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Gen Jumper's "Sight Picture"
(Air Force Chief of Staff)

CHIEF'S SIGHT PICTURE:
Capabilities Review and Risk Assessment

What happened to the Quarterly Acquisition Review Program (QAPR)? In this Sight Picture, I'll answer that question--but to do so, I first need to give you a sense of the bigger picture in which the answer fits.

The Air Staff is currently working hard to lay the foundation for the next step in our transformation to a capabilities-focused Expeditionary Air and Space Force. Our goal is to warfighting effects, and the capabilities we need to achieve them, the drivers for everything [illegible] the development of new Task F[illegible]
[illegible] will guide our planning and programming, requirements reform, a[illegible]
We have identified seven Task Force CONOPS that we are fleshing out--Global Strike Task Force (GSTF) is a prominent example and is the farthest along in development.

It's in this context the Air Staff has designed a new review to replace the QAPR--we call this new approach a Capabilities Review and Risk Assessment (CRRA). The focus of the CRRA will shift from a progra[illegible]iew to a review of ho[illegible]rograms contribute to warfighting ca[illegible]ffects. As with all aspects of our transfo[illegible]orce CONOPS.

[illegible]e briefly describe the logic behind the CRRA construct. For our first time out [illegible]te, we'll review the capabilities that support the GSTF. The CRRA will evaluate the [illegible]ealth and risk of each of the required GSTF capabilities over the next 20 years. To accomp this, we will review acquisition programs and discuss disconnects and prioritization in relati how the programs support GSTF capabilities. The bottom-line goal for the CRRA is to give senior USAF leadership an operational, capabilities-based focus for acquisition program decisionmaking.

The target for the GSTF CRRA is June 2002. As future Task Force CONOPS are defined, we will hold CRRAs accordingly. SAF/AQ and AF/XO will lead us through this first cycle, with major input from the MAJCOMs. Much work needs to be done through the next four months to make this a successful review, and I need your support so our Air Force can move in the right direction--towards using operational warfighting effects as the origin for every piece of hardware and software we buy.

Concepts of Operations (CONOPS) ... will guide our planning and programming, requirements reform, and acquisition.

...make warfighting effects, and the capabilities we need to achieve them, the drivers for everything we do.

…Air Staff designed a new review to replace the 'Quarterly Acquisition Review Program'--we call this new (process) approach a Capabilities Review and Risk Assessment (CRRA).

... shift from a program review to a review of how our programs contribute to warfighting capabilities and effects.

AF Capabilities–Based Planning

National Strategies

SECDEF Planning Guidance

Joint Concepts



Planning



10 Air Expeditionary Forces

Joint Integrated Capability is the absolute requirement.
To be effective, you must be able to "plug and play"

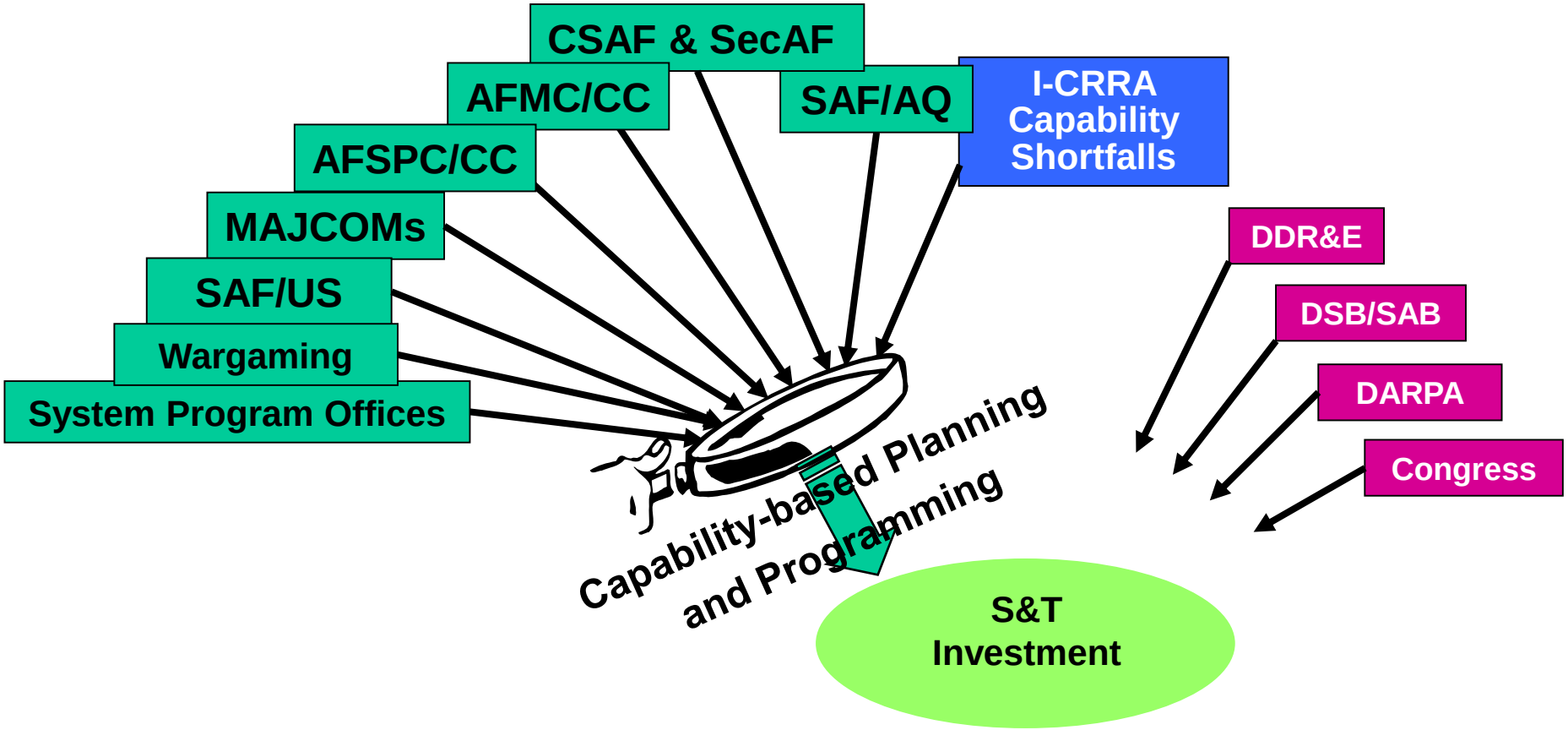
Programming
Budgeting
Execution

Integrated Capability Review and Risk Assessment (I-CRRA)

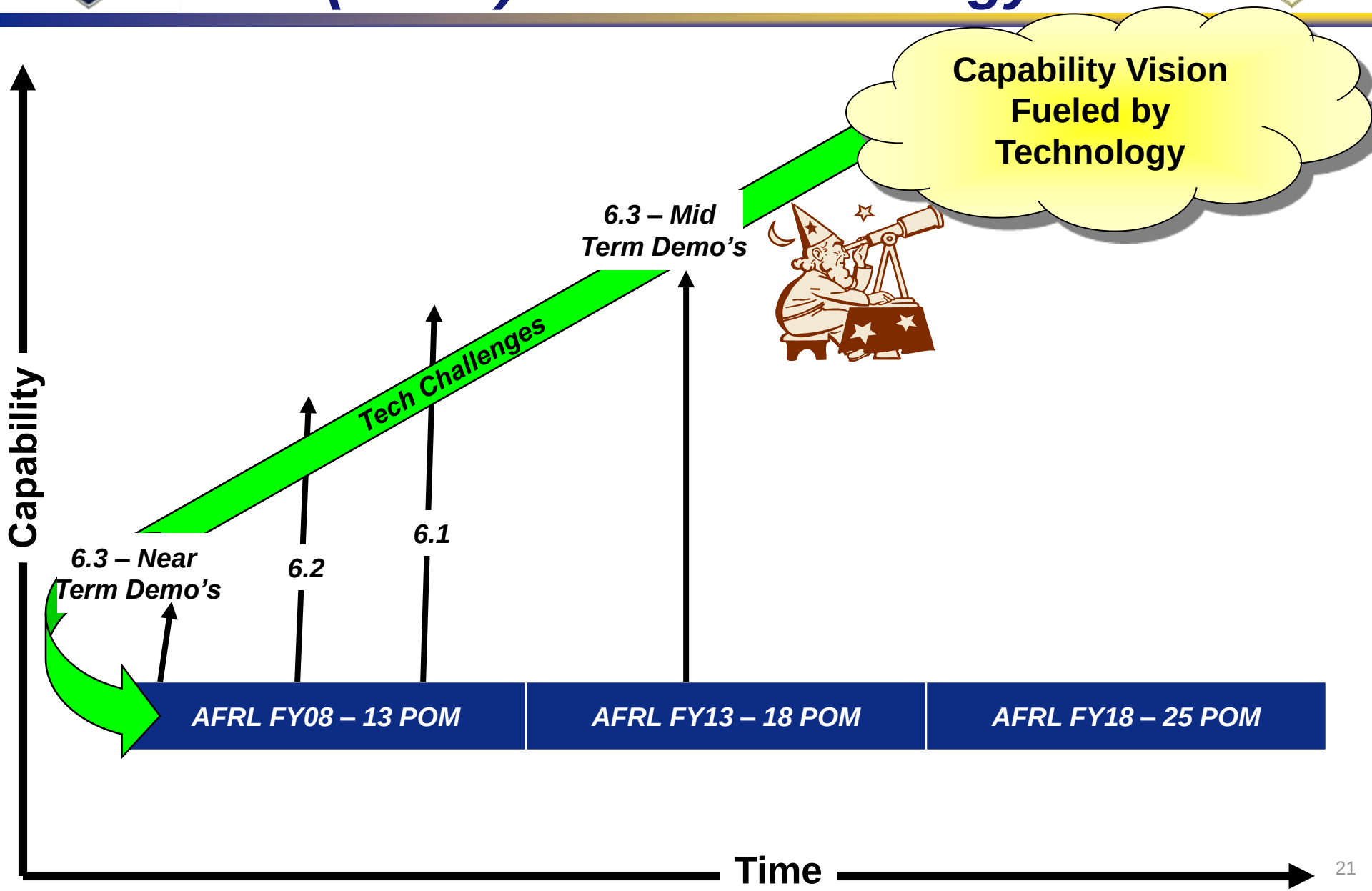
Global Strike CONOPS	Homeland Security CONOPS	Global Mobility CONOPS	Global Persistent Attack CONOPS	Nuclear Response CONOPS	Space & C4ISR CONOPS

Agile Combat Support CONOPS

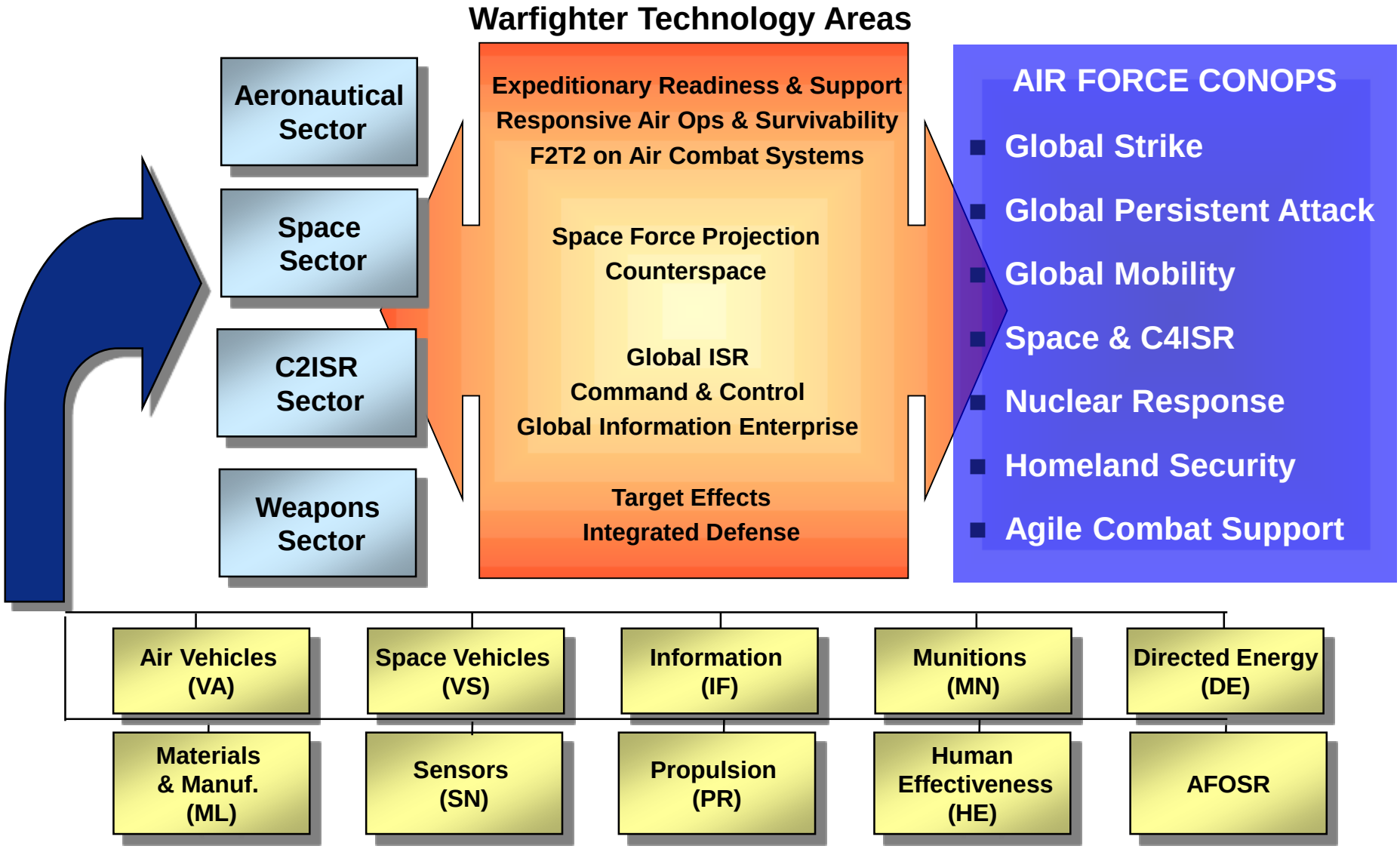
S&T Investment Development



Focused Long Term Challenge (FLTC) Problem Strategy

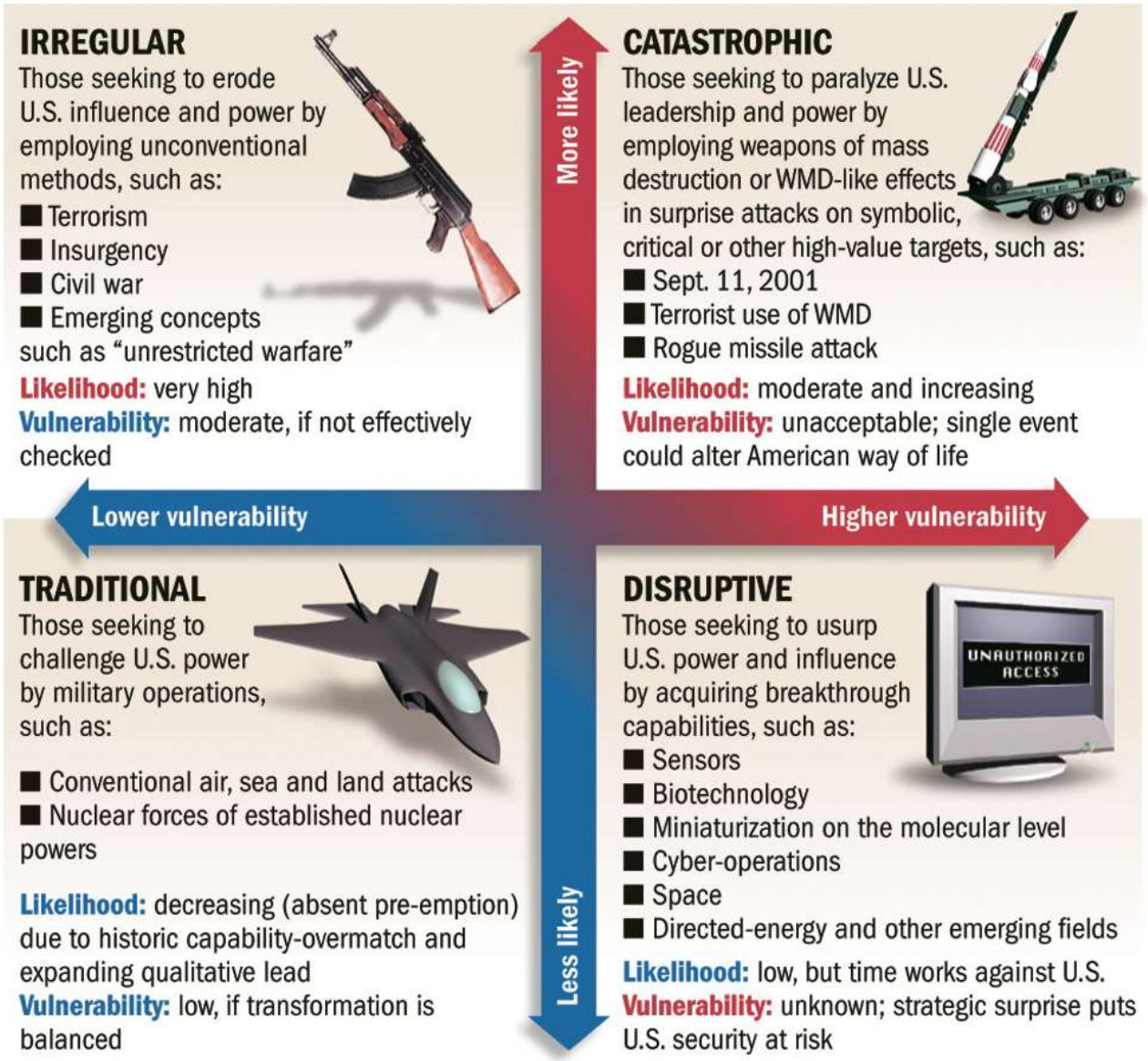


Sector Focus
Technology to Capability to CONOPS

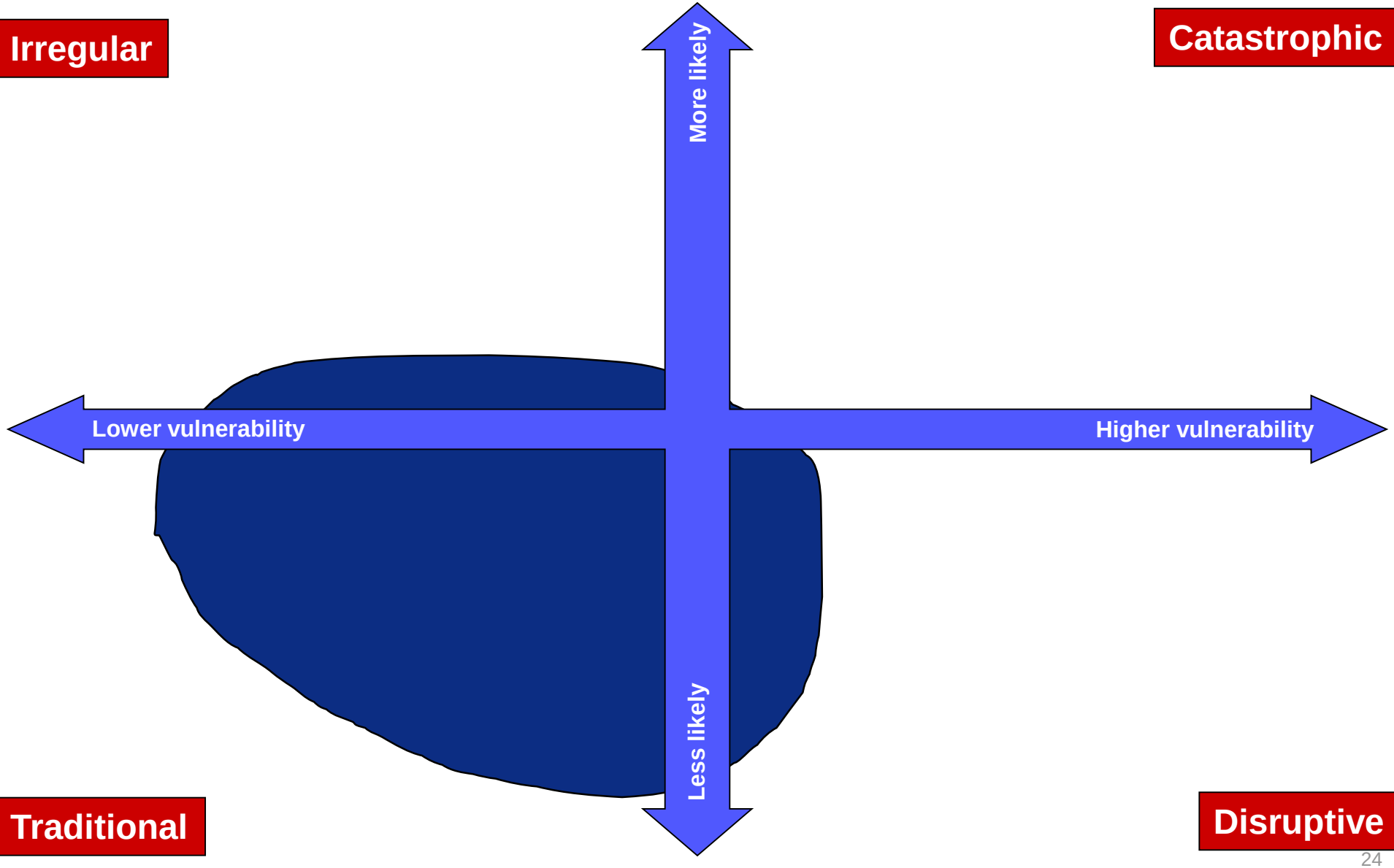


Changing the Plot

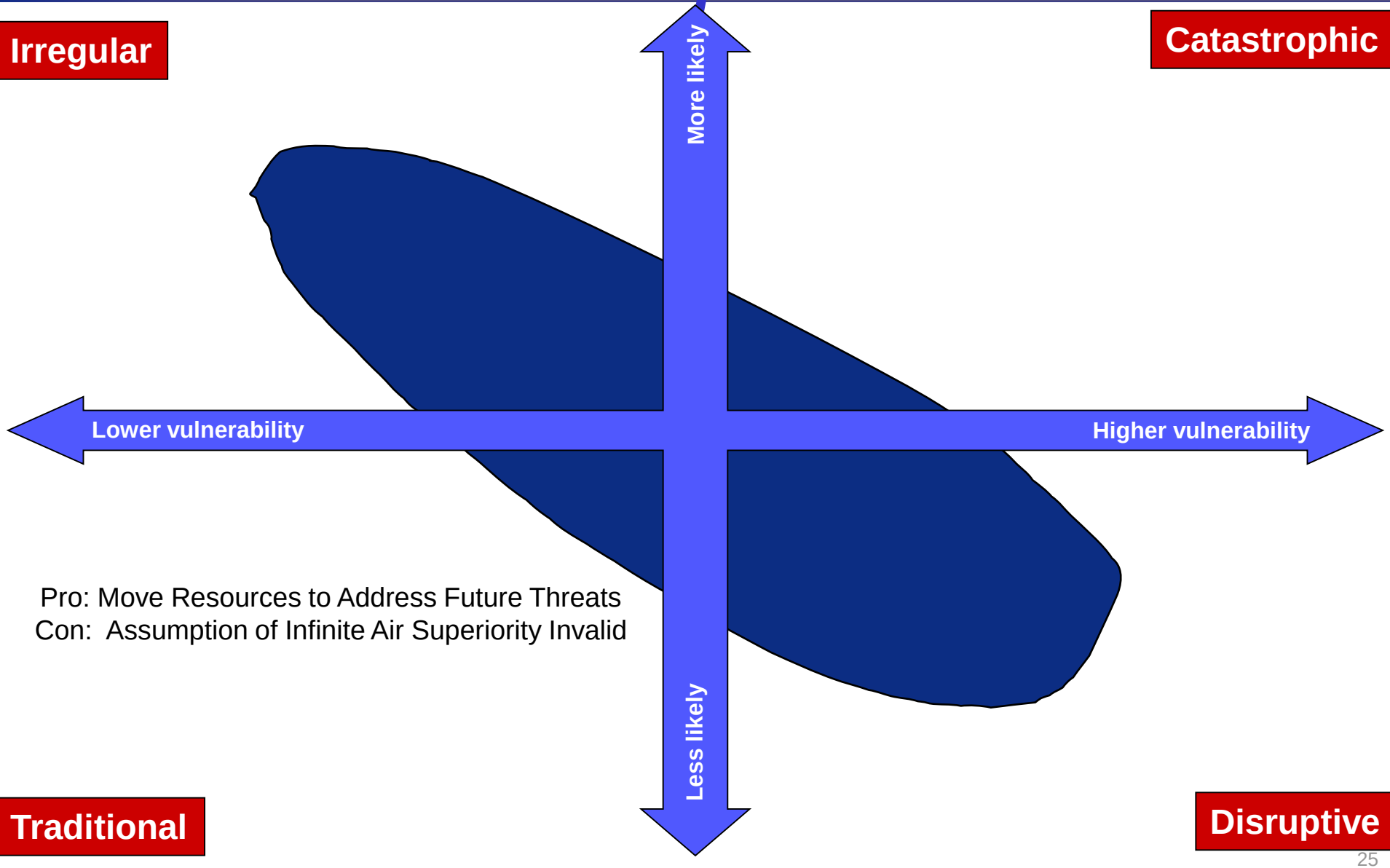
- **For decades the Pentagon's war plans focused on countering conventional military threats.**
- **New planning scenarios focus on preparing for a wider range of contingencies**
- **To migrate from Traditional to other areas requires *Revolutionary Technology Enablers***



USAF Coverage – Current View

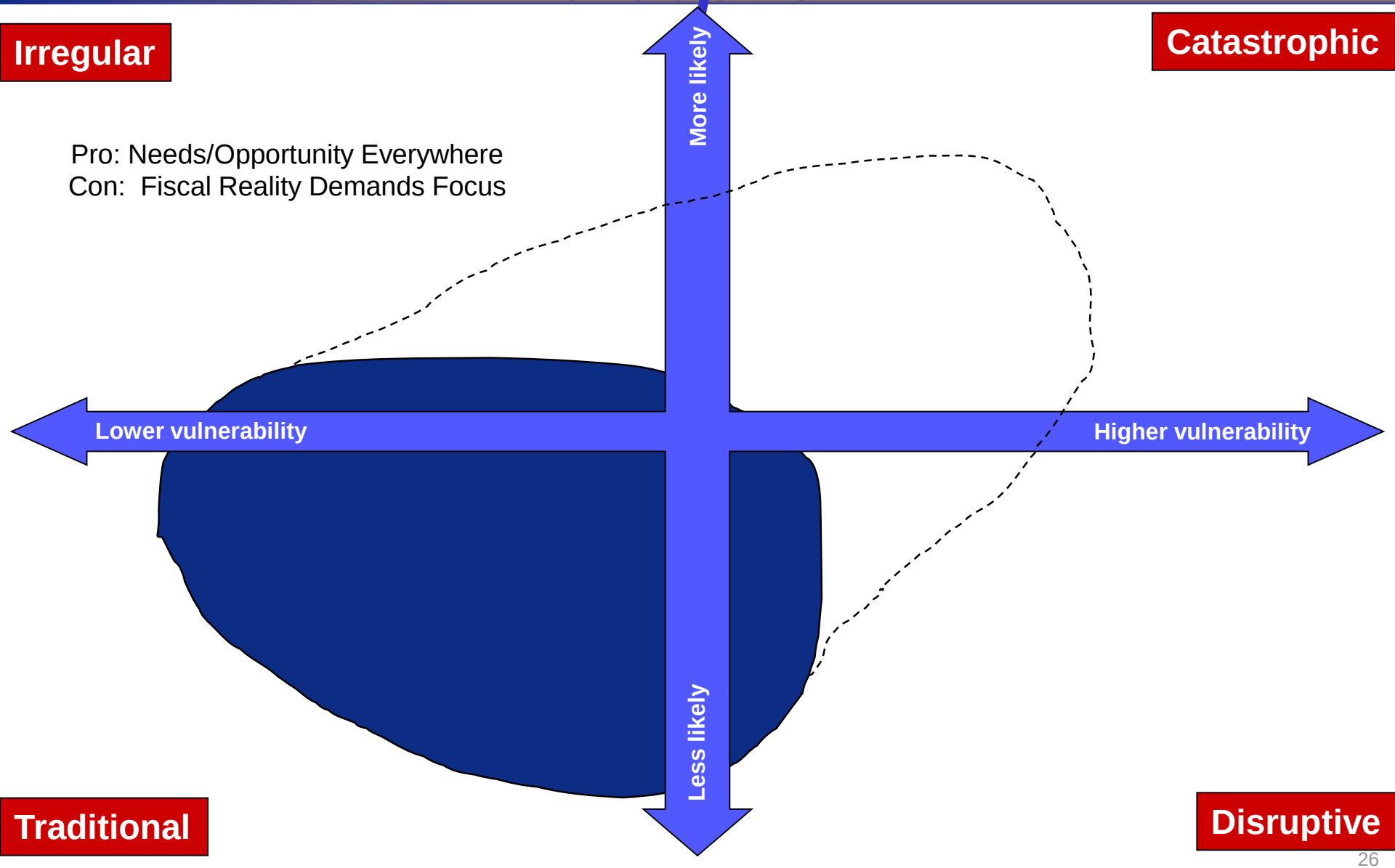


Future USAF Coverage – Perception 1

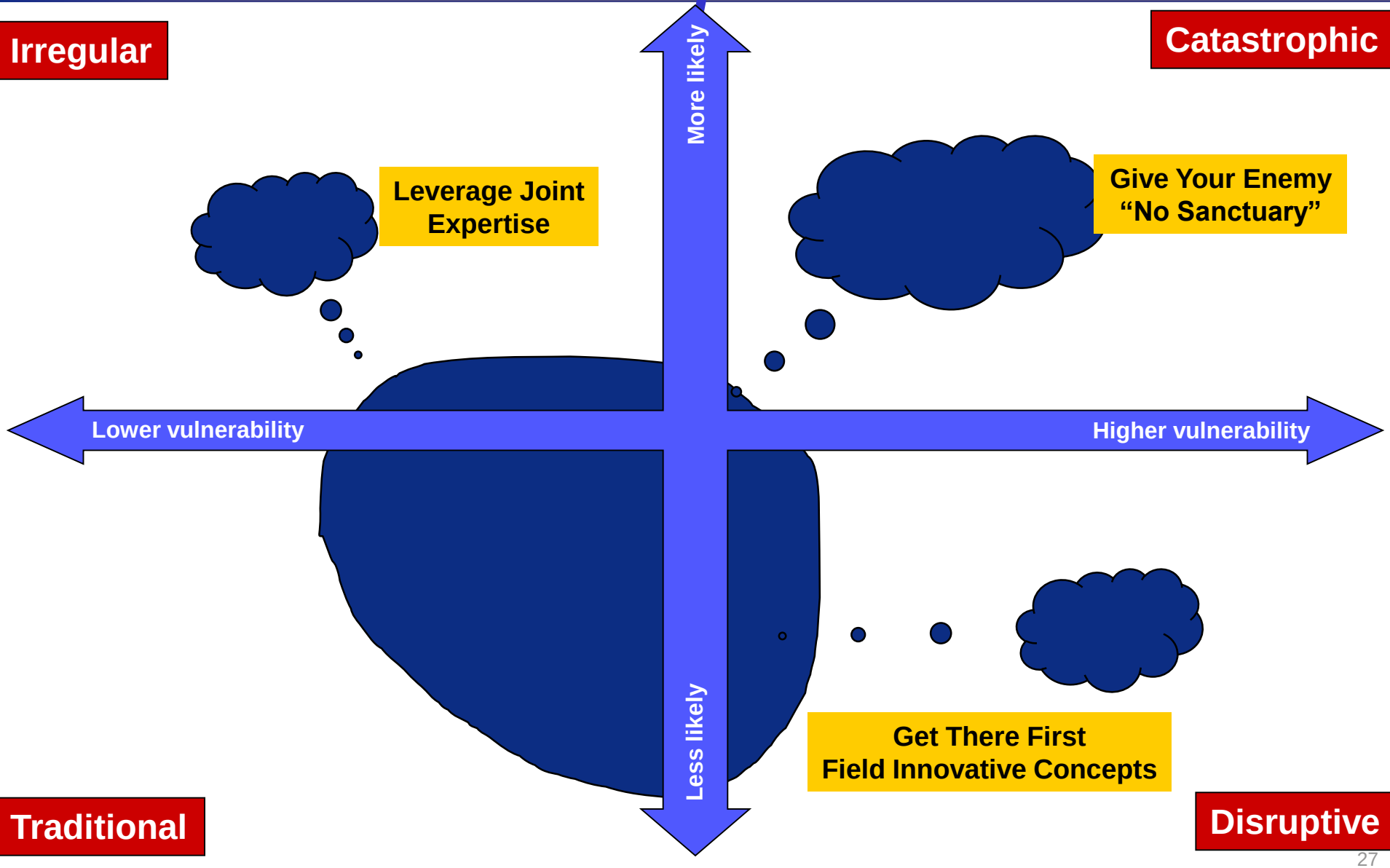


Pro: Move Resources to Address Future Threats
Con: Assumption of Infinite Air Superiority Invalid

Future USAF Coverage – Perception 2



Future USAF Coverage – Perception 3

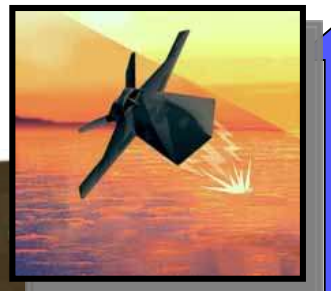


Technology Enablers

Irregular

Catastrophic





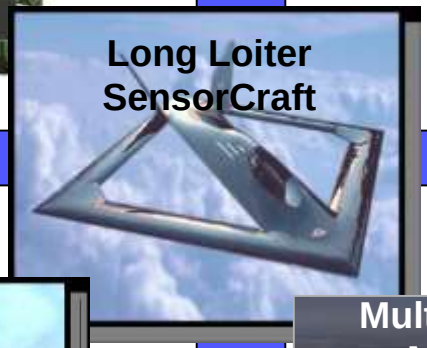
High Power Microwaves

More likely



Single Stage to Orbit





Lower vulnerability

Higher vulnerability

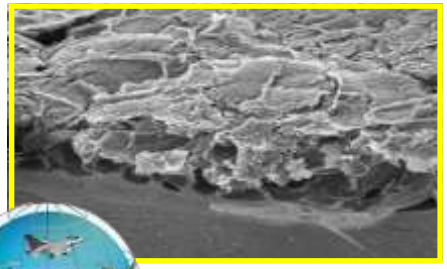


Nano ChemBio Sensors

Self-Healing Materials







Less likely



Quantum/Bio Computing – Advanced PsyOps

Traditional

Disruptive

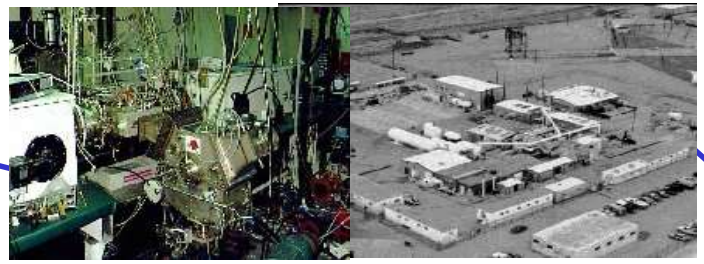
Agenda

- AFRL – Who We Are
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Increase Multi-Disciplinary Solutions



Adaptive Optics

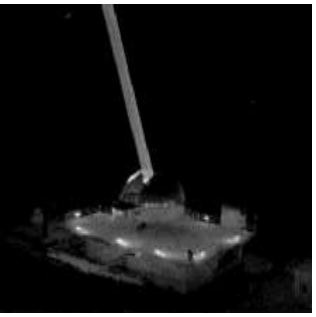


Chemical Oxygen Iodine Laser



Airborne Laser Laboratory

30+ Years of Air Force S&T investments in beam control and high energy lasers have made an ABL Possible



1.5m Telescope





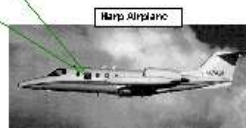
3.5m Telescope





Atmospheric Compensation





Atmospheric Measurements

On the Horizon
S&T for Special Operations





REVOLUTIONARY TECHNOLOGY

- Directed Energy
- Next Generation Gunship S&T
- Power
- Fabrication
- Micro-Munitions
- Micro-Communication
- Micro-Sensors
- Counter-Proliferation
- Reasoning Logic
- Quality Assurance
- Analytic Toolkit

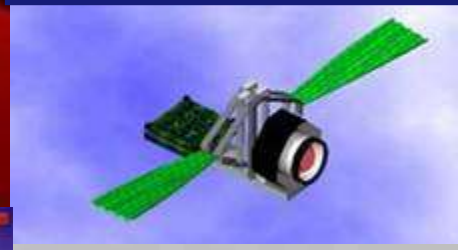








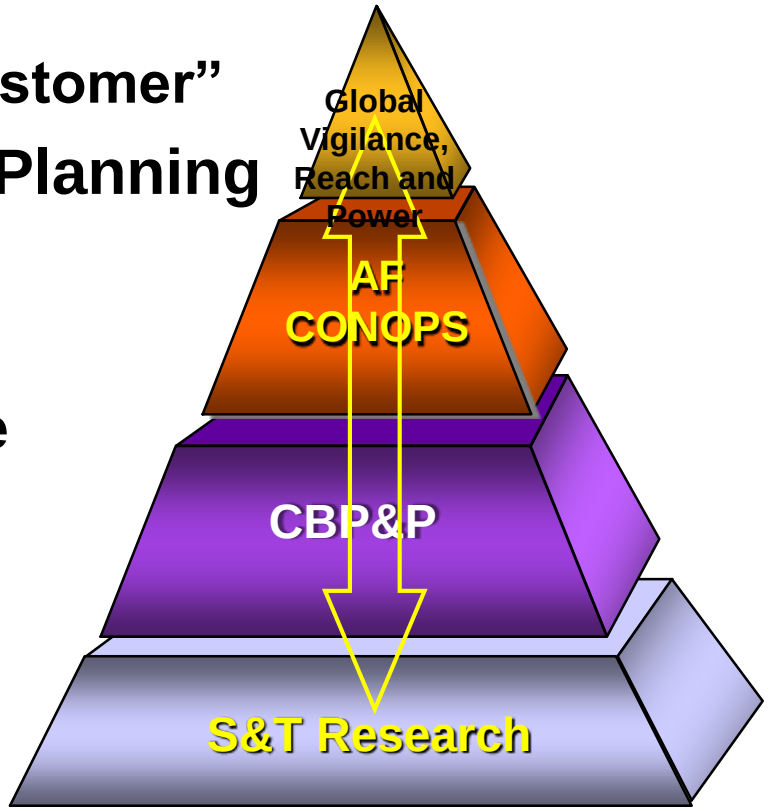






Summary

- Special Partnerships exists between AFRL and industry
  - Industry is a “supplier” and a “customer”
- AFRL driven by Capability Based Planning
  - I-CRRA defines tech pull
  - AFRL defines tech push
  - Industry needs to speak the same language
- Changing “nature of warfare” is driving future
  - Irregular/catastrophic/traditional/ disruptive
  - AFRL is changing investments in response
  - New DoD directions will impact Industry




QUESTIONS?
Defending America by unleashing the
power of innovative science and technology

Urban Warfare Discussion

6th Annual NDIA

S & E Technology Conference

Joe Braddock

20 April 2005

Urban Warfare Discussion Outline

- Context
- Historical Considerations
- Opinions Concerning Current Capabilities and Possible Improvements
- Summary
- Question and Answer Session

Context

- Purpose: Achieve Political Objectives….

…Through control of Land, People and Resources*

- Assumptions
  - Urban Operations are an Included Force Design Case
  - General Purpose Forces with Appropriate Training Can Succeed in such Operations
  - Their Materiel is Adaptable

* Papers written by Lt. Gen Paul Van Riper (USMC, Ret.) and MG Robert Scales (USA, Ret.)

One Description of Current U.S. Force Capability Sizing

- Descriptor: 1-4-2-1
- Meaning
  - 1 = Defend Homeland
  - 4 = Provide Forward (Overseas) Presence Circumstances
  - 2 = Conduct Near Simultaneous Regional Conflicts
  - 1 = Conduct Extended Stabilization Campaign

Urban Challenges are again Implicitly Included

History

Stalingrad (1943)	Beirut (1982-84)	Baghdad (2003)
Aachen (1944)	Mogadishu (1992-1994)	Najaf (2003-04)
Manila (1945)	Groznyy (1994-96-2000)	Kirkuk (2003)
Hue (1968)		Fallujah (2004)

Trends

- Slow Expansion of Innovations at the Operational Level of War
- More Rapid Expansion of Tactical Combined Arms and Recent Joint C^2 and Execution Collaboration
- Evolutionary Improvements in Survivability and Controllable Lethality at the very point of the Tactical Spear

Proposed Capabilities Pillars for Discussion

Intellectual Underpinning

Manning the Force *

Training

Networks and Collaboration

ISR

Survivability

Lethality

Mobility

* Mentioned because of its centrality but not discussed in detail

Opinions

Intellectual Underpinning and Training

- Exploiting a Broad Body of Lessons Learned from the Field
- Expanded Concepts for Improvements at the Operational Level of War
- Expanded Urban Operational-Tactical Training Facilities.
- Large Scale but detailed Constructive Tools.

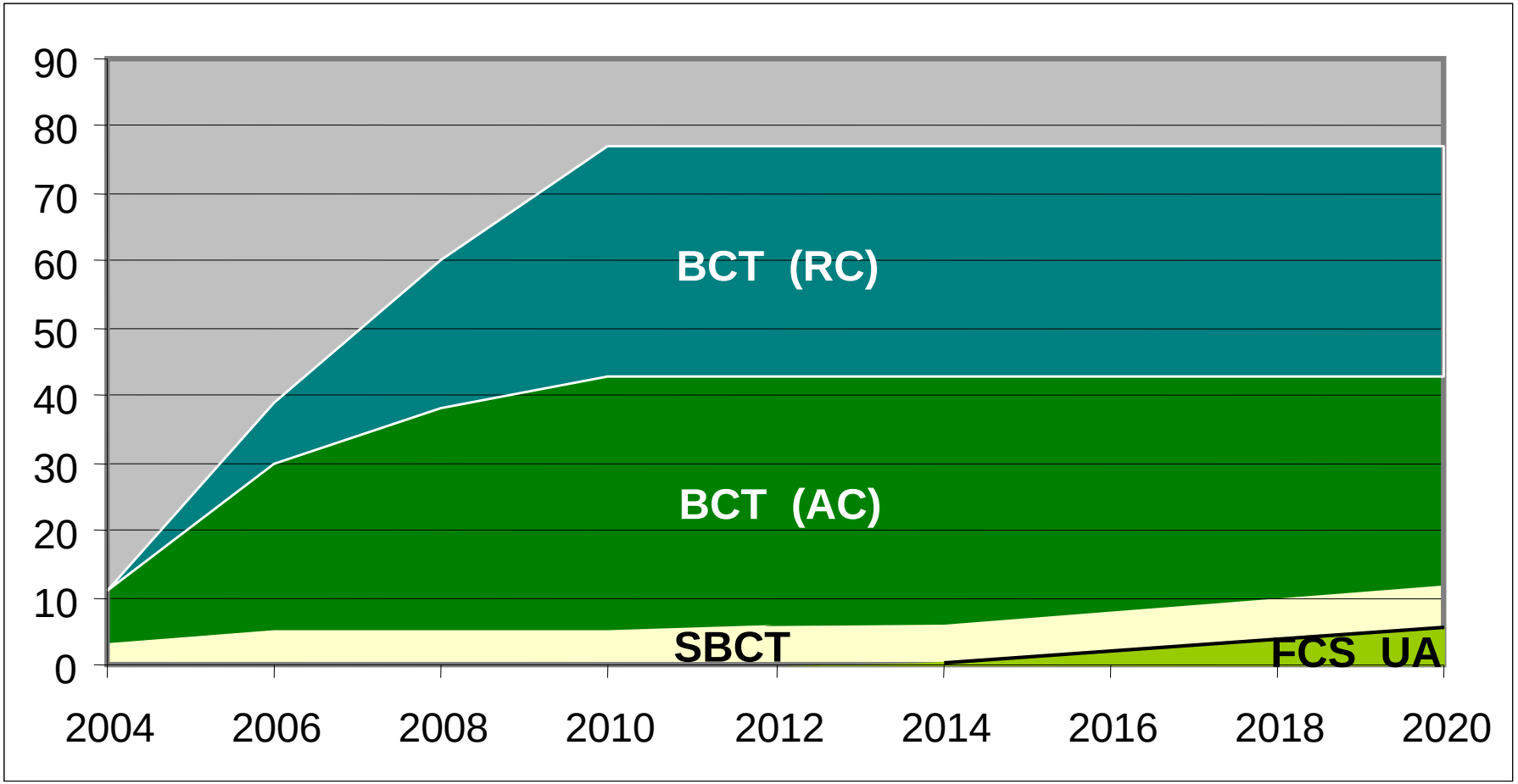
- High Resolution "Cause and Effect" Experimentation

Opinions

Leveraging Networks and Collaboration

- Serious Physics, Engineering and Technical Operating Challenges
  - Transport Path Establishment and Related Losses
  - Establishment of Reliable Networks of Adequate Quality of Service
  - Forming Networks of Useful Scales
- Approach being pursued involves
  - "3D" Geometries
  - Clusters and "Points of Presence" Topologies
  - Advanced Waveforms and Automated Network Control
  - Affordable Electronically Steerable Antennas

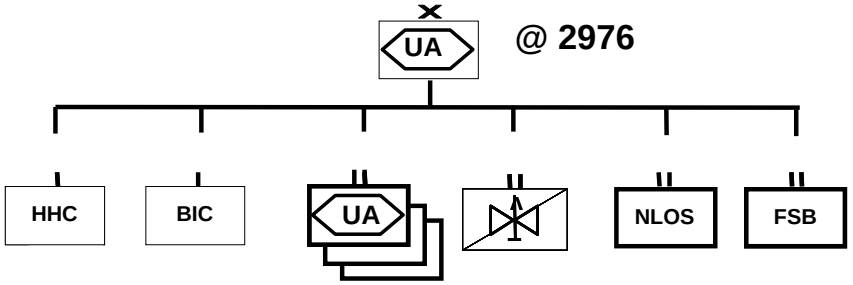
BCT Conversion & FCS Fielding Schedules

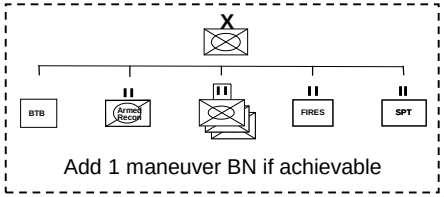


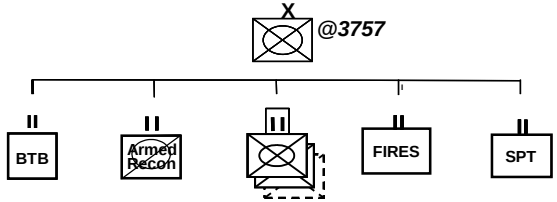
Heavy & Infantry BCT Transition to FCS UA

(Synergy of New BCT Design)

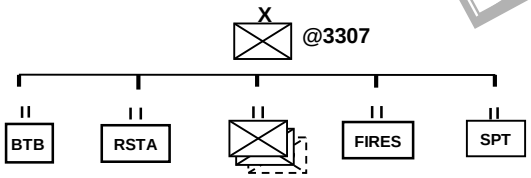
- **BCT Design and TOE are Deliberately FCS-like**







Current BCTs



Modular Conversion Complete

FCS 1st UA FOC

2004 — 2007 — 2012

Opinions: ISR Capabilities

- Today's ISR (and target acquisition) systems are limited individually by urban circumstances.
- Improving urban ISR capabilities for all echelons will require
  - A much better definition of signatures and clutter than is now available
  - Layered Sensors that are "networkable"
  - Technical augmentation for all human collection, not just trained HUMINT specialists and Search and Correlation Software Advances
  - Standoff and Identification achieved through new system of heterogeneous system architectures

Opinions: Survivability

- Some Survivability enhancements apply equally well across the combat spectrum
  - Passive Protection
  - Reactive Protection
  - Active Protection
- Proactive, Preventive and Retributive enhancements require ISR advances. When achieved these have the added advantage of being deterrents as well
- Directed Energy in its various forms should be considered as competitive means for the above
- Robotics contributions appear to be substantial but until FCS is fielded, these are being applied slowly

Opinions: Lethality

- Urban engagement execution could be enhanced with 3-D weaponry within the confines of the Urban Canyons
- The Large Diversity of U.S. Inventory weapons suggests investigation of such possibilities.

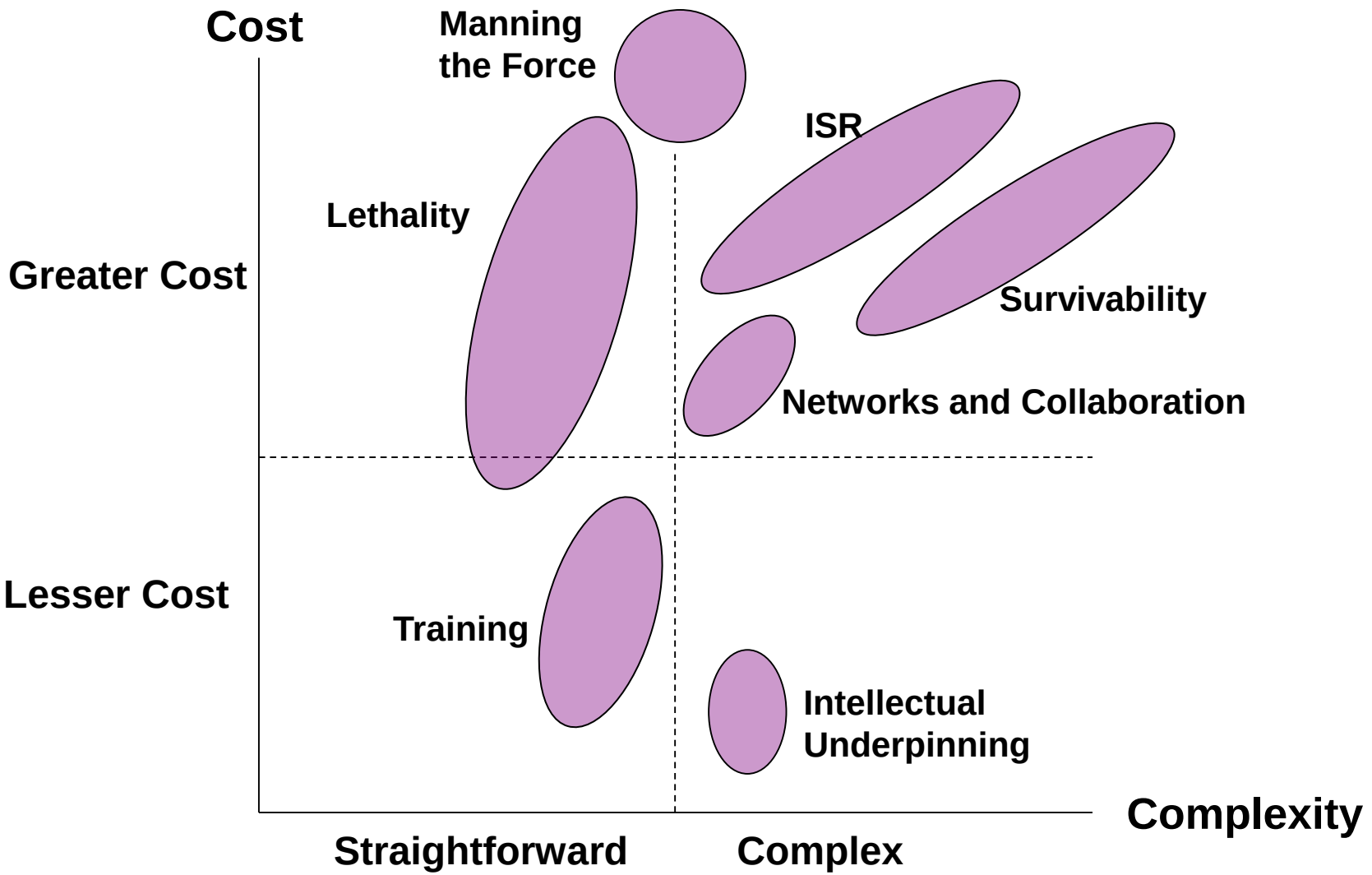
Opinions: Mobility

- With the exception of Heavy Lift VTOL, now under study, there are no Urban related mobility advances being pursued

Combined "Scoreboard" (Concepts and Technologies)

Capabilities Pillar	Now	Near Term	Far Term
Intellectual Underpinning	**X**	**X**	
Training	**X**	**X**	**X**
Networks and Collaboration		x	**X**
ISR	x	x	**X**
Survivability		x	**X**
Mobility			**X**
Lethality	x	**X**	**X**

Opinions


Cost
Manning the Force
ISR
Lethality
Greater Cost
Survivability
Networks and Collaboration
Lesser Cost
Training
Intellectual Underpinning
Complexity
Straightforward
Complex

Questions?

Biological/Chemical Countermeasures RDT&E: at the Department of Homeland Security

6th Annual Science & Engineering Technology Conference
Charleston Area Convention Center

April 20, 2005

Mr. Lance Brooks
Biological/Chemical Countermeasures
Plans, Programs, & Budgets
Science & Technology

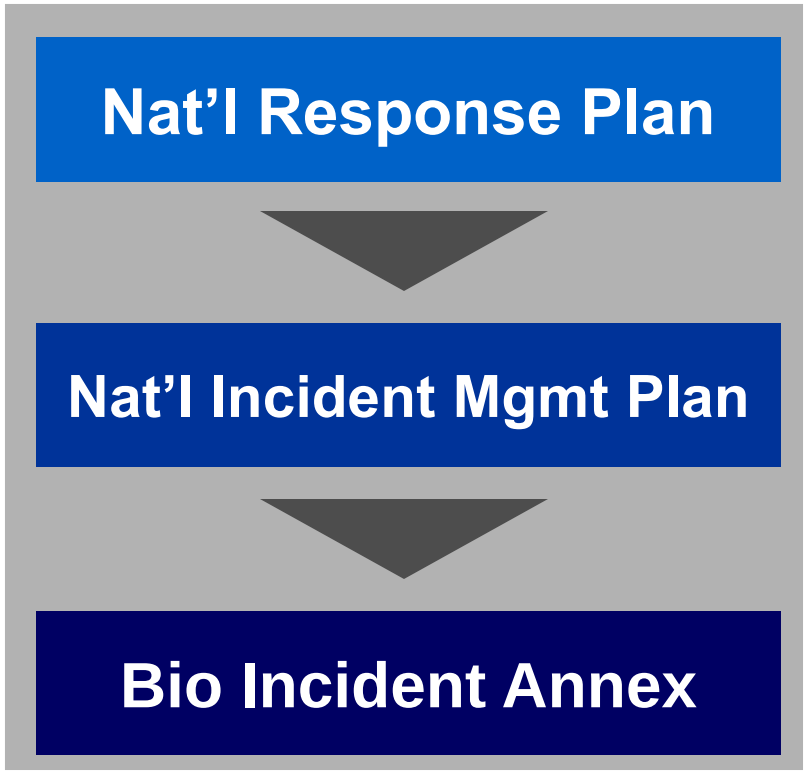
Homeland Security

HSPD-10 lays out an integrated end-to-end biodefense strategy

THREAT AWARENESS	PREVENT & PROTECT	SURVEILLANCE & DETECTION	RESPOND & RECOVER
▪Intel	▪Diplomacy	▪Attack Warning	▪Response Planning
▪Assessments	▪Interdiction	▪Attribution	▪Risk Comm
▪Anticipate future threats	▪Critical Infra Protection		▪Med CM
			▪Mass Cas Care
			▪Decon

Homeland Security

DHS is responsible for coordinating national biodefense efforts



- **DOS**: international aspects
- **DOS, DoD, DoJ, & IC**: proactive prevention
- **HHS:** medical countermeasures & mass casualty care; anticipate future threats
- **USDA**: Ag biosecurity
- **EPA:** decontamination
- **DHS:** assessments; CI protection; attack warning; forensic analysis; response plan; risk comm

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Several major initiatives are underway as part of this integrated strategy







- **BioShield**: to speed the development of medical countermeasures
- **BioSense**: to develop a national health surveillance system
- **BioWatch**: to develop a national urban environmental monitoring system
- **Integrated Biosurveillance**: to integrate human, animal, plant surveillance with monitoring of the air, food, and water and with intelligence data to provide overall situational awareness

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Biological Countermeasures Portfolio



Mission Statement

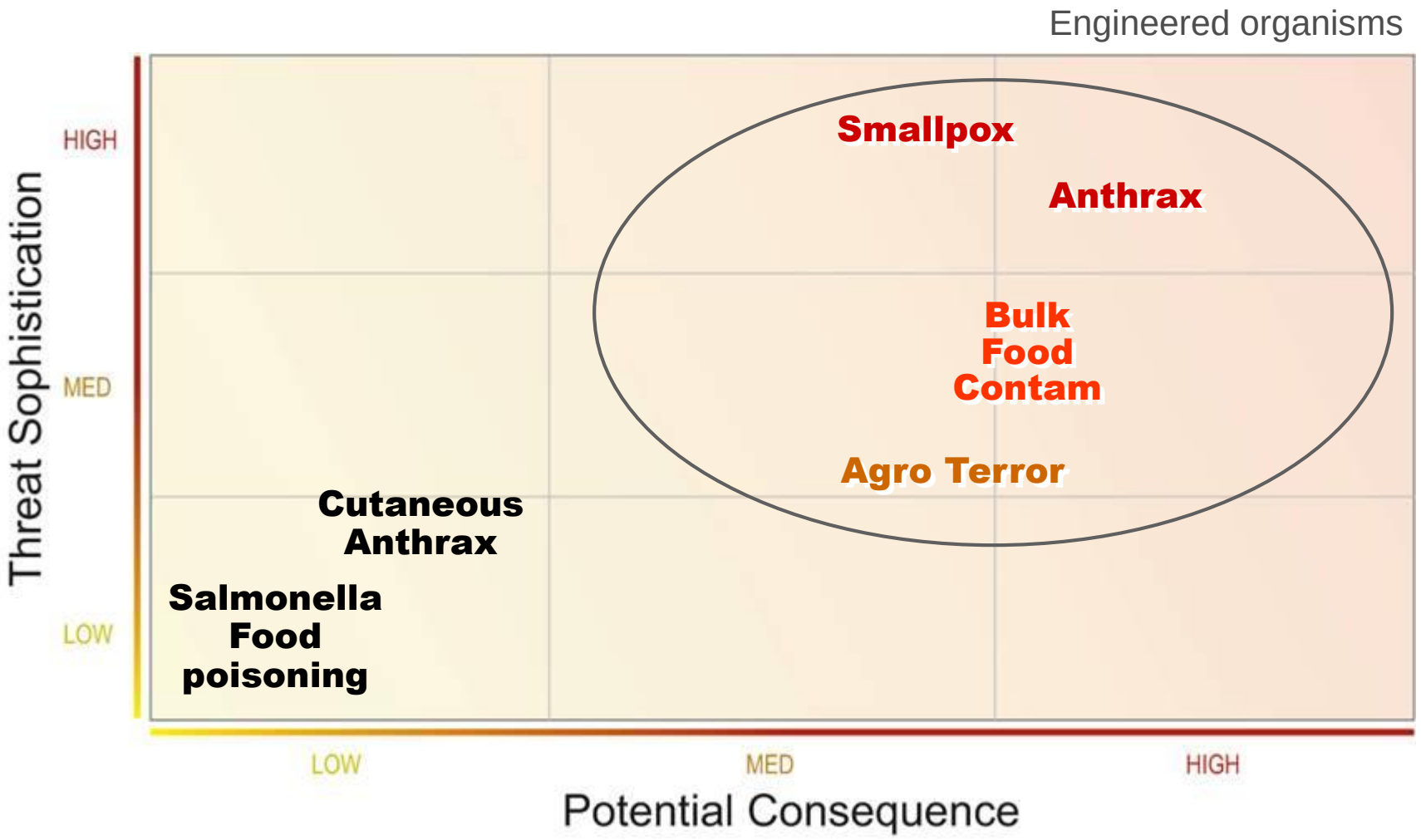
To provide the understanding, technologies, and systems needed to …..protect against……biological attacks on this nation's population, agriculture or infrastructure.

Objectives

- **Develop an integrated, end-to-end, national biodefense architecture against all biological threats**
- **Provide decision support tools to anticipate, prevent, prepare for and respond to possible events**
- **Support partnering agencies**
- **Coordinate with partnering agencies in intelligence & defense**
- **Conduct RDT&E and transition to deployment needed technologies & systems**

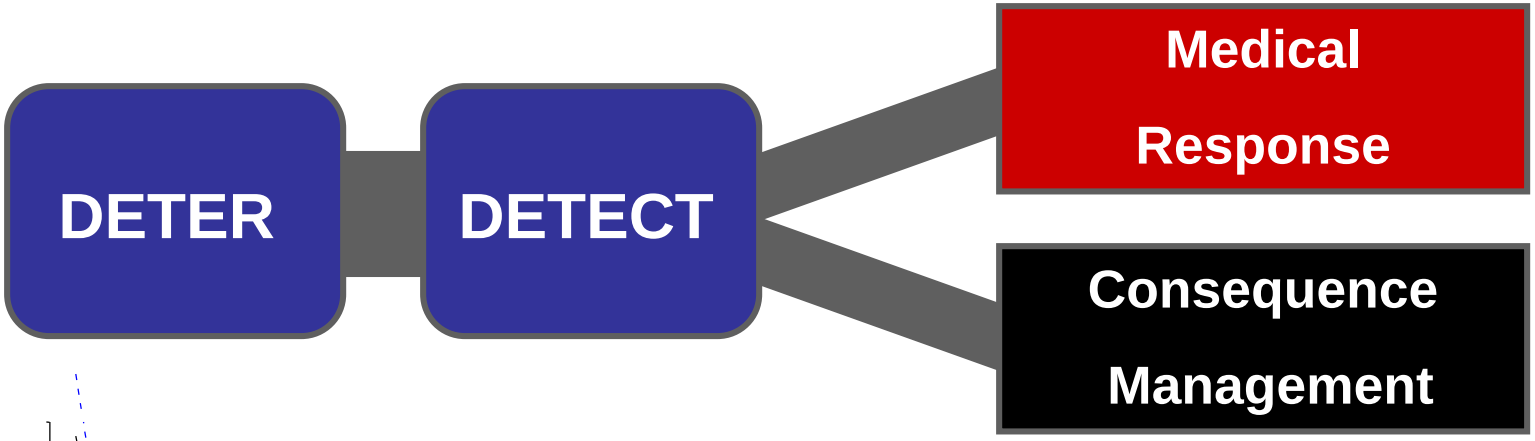
Homeland Security

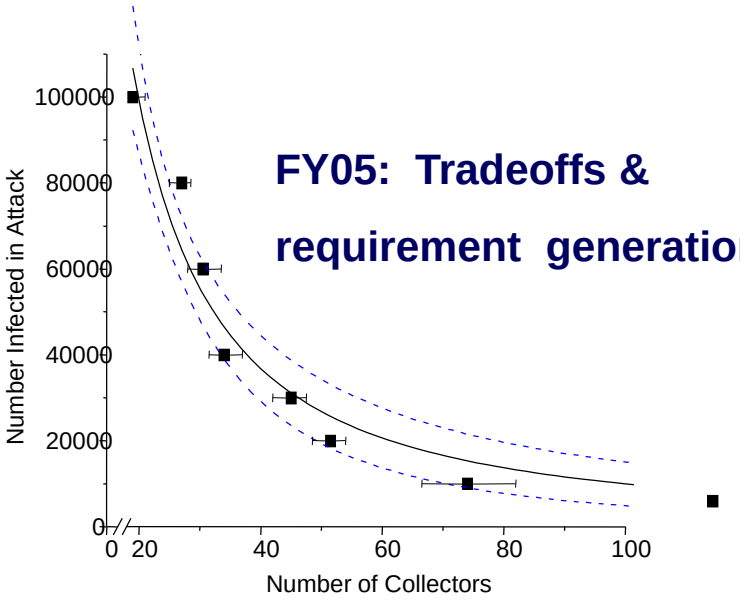
Portfolio's initial emphasis is on high consequence threats



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Systems studies guide an integrated end-to-end response





FY05: Tradeoffs & requirement generation

FY06-08: Gaming, simulated testing; red-teaming & training



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NBACC provides scientific support for threat characterization



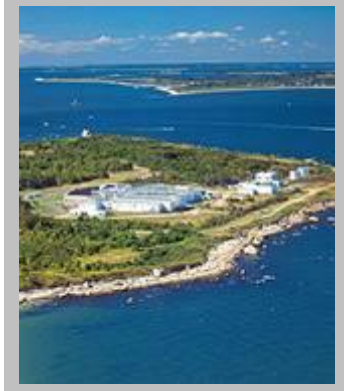
Over the next five years:

- **Threat Characterization Center**
  - Conduct threat & risk assessments
  - Close key gaps in 1st Gen agents
  - Develop a strategy for 2d Gen
- **BioForensics Analysis Center**
  - the designated lead national facility for Bioforensics analysis
- **Knowledge Management Center**
  - Rapidly provide BT management information & options

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NBACC & Plum Island are part of a joint USDA-DHS agricultural strategy







Net assessment of the FAD threat

- Animals as aerosol generators
- Viral stability/survivability

Development of field portable diagnostics

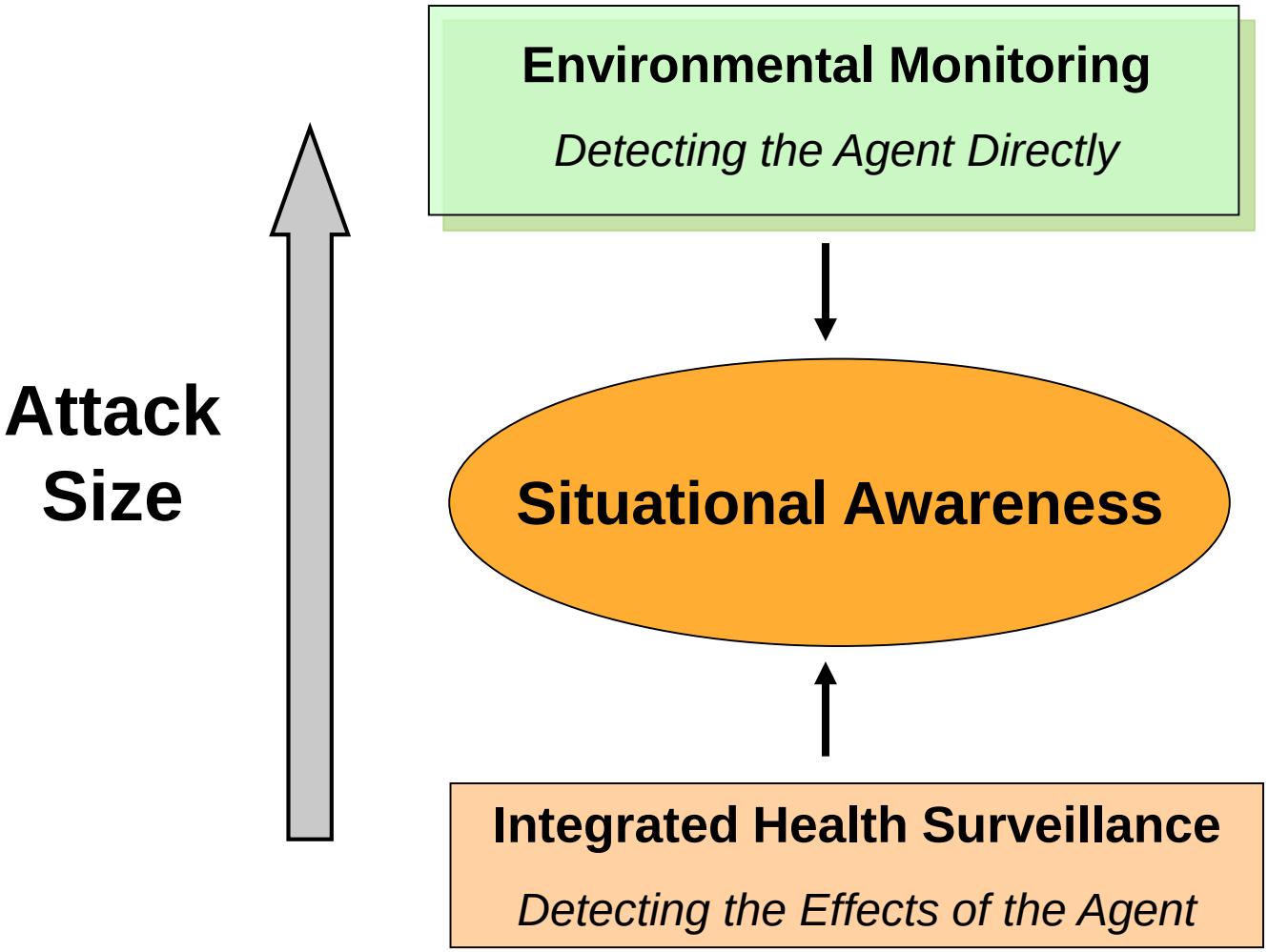
- National and international validation

Vaccines and therapeutics

- Improve on current vaccines
- Explore vaccine alternatives
- Develop anti-virals

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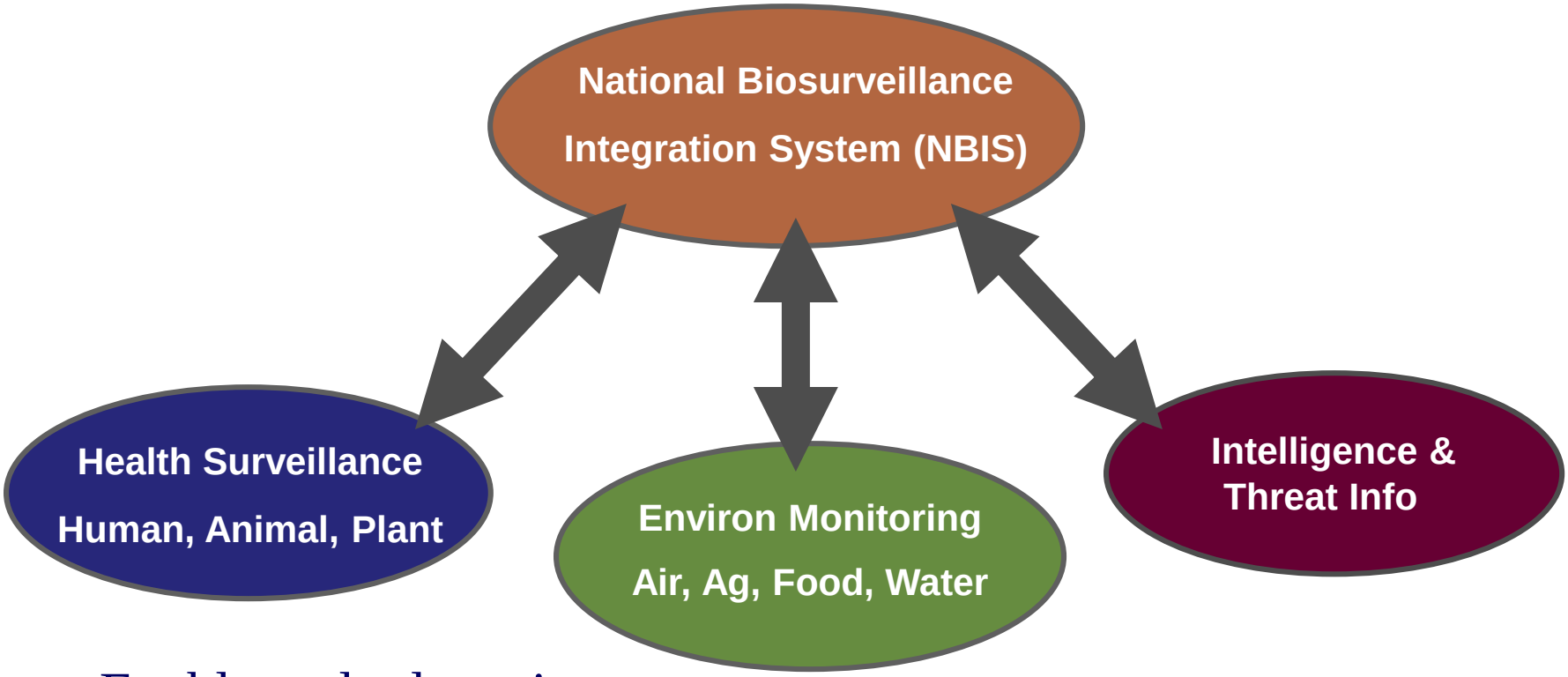
Bio-Warning & Incident Characterization



Defense of Cities Study
The Washington Institute &
Sandia National Laboratories

Homeland Security

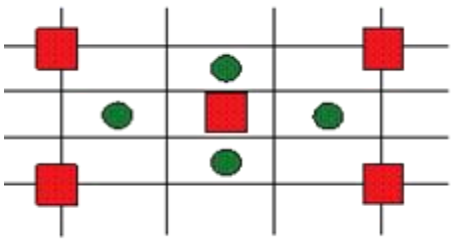
National Biosurveillance Integration capability



- Enable early detection
- Provide situational understanding to guide response
- Share information amongst partners

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Urban Monitoring Systems



Wide Area

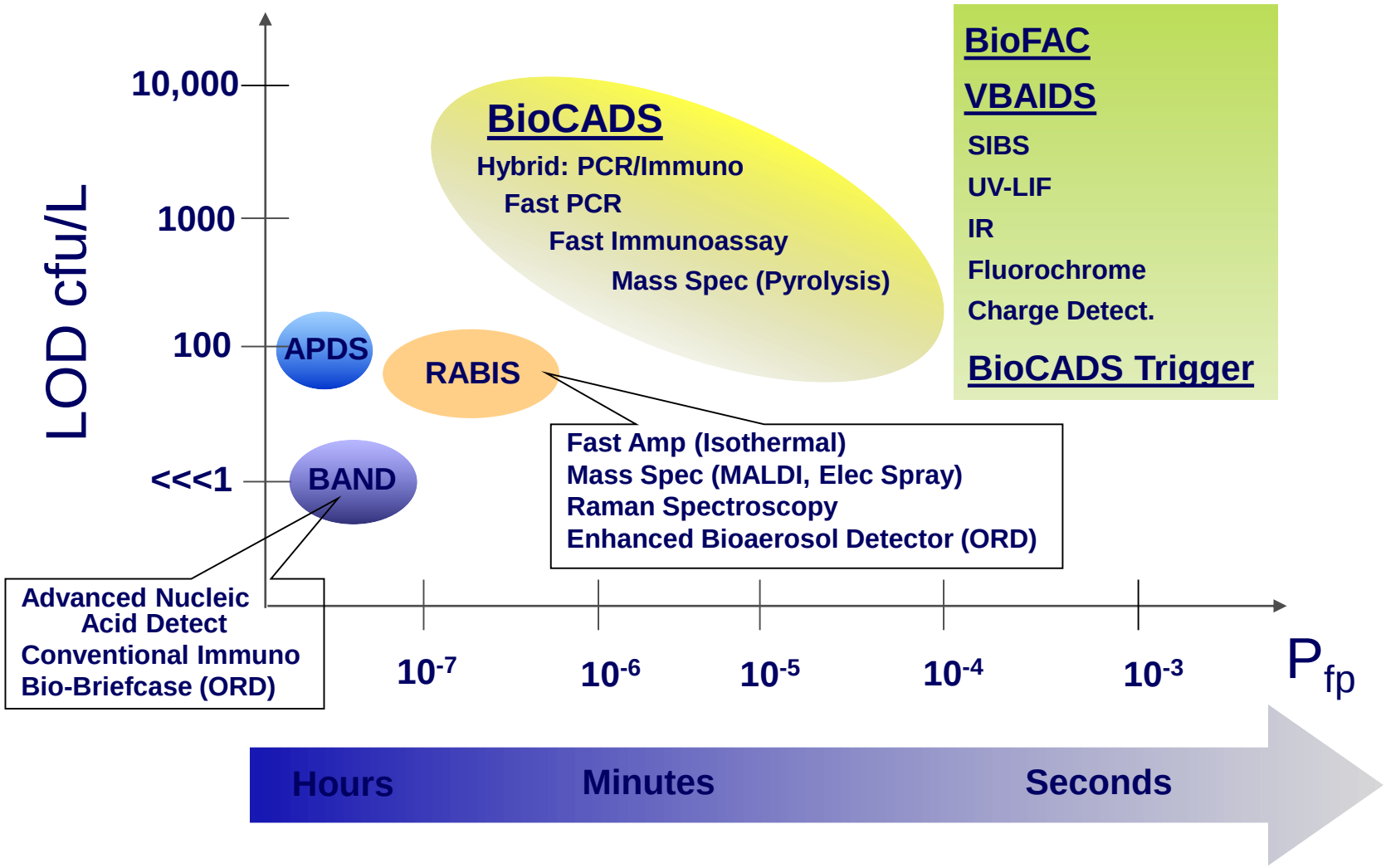




- **Wide area monitoring (detect-to-treat)**
  Phase 1 BioWatch (FY03) to increased sampling (FY05-06) to networked sensors (FY09-10)
- **Facility monitoring (detect-to-warn)**
  Simple triggers/low regret responses (FY05-06) to improved detect-to-treat sensors (FY09 - 10) to improved design of new facilities
- **Coordination with other national programs**
  With DoD force protection (BioNet, Guardian), with USPS Biohazard Detection System, with EPA and DARPA building protection programs

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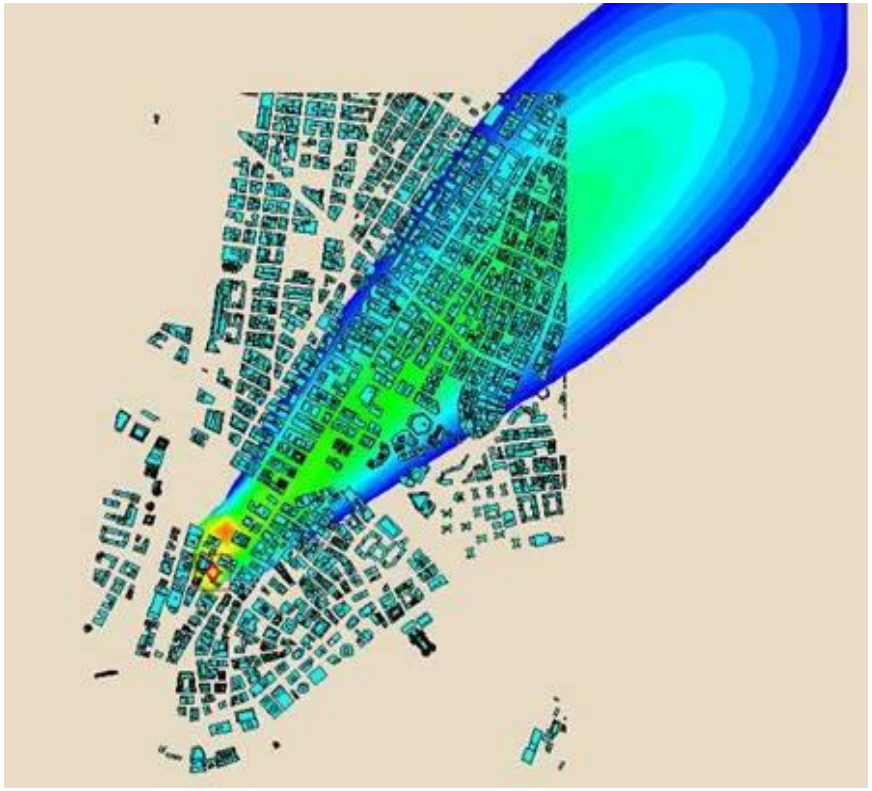
Bio-countermeasure Sensor Strategy



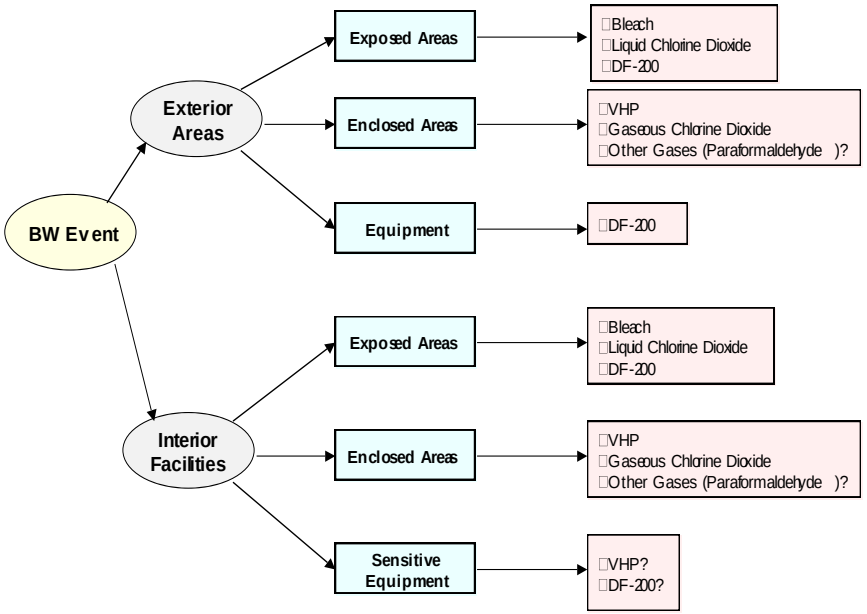
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Respond and Recover

Incident Characterization Tools and Playbooks



Systems Approach to Urban Decontamination

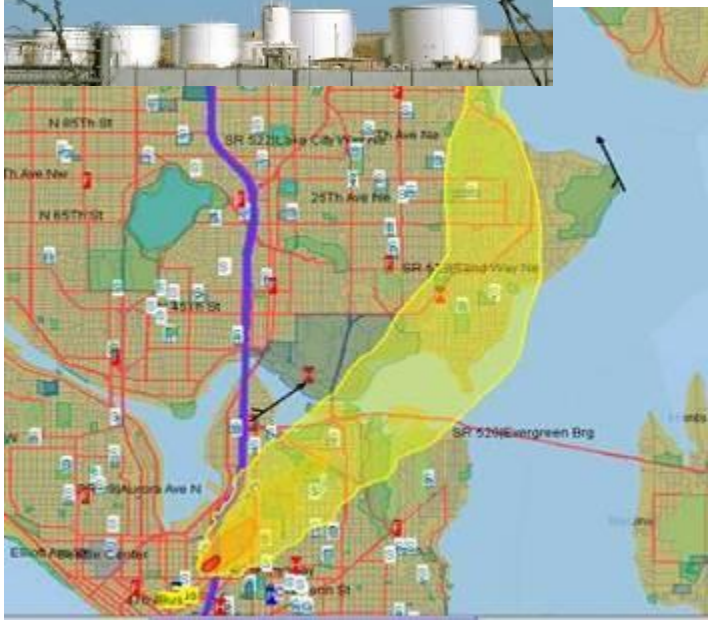


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Chemical Countermeasures Portfolio







Mission Statement

Enhance and coordinate the nation's capability to anticipate, prevent, protect, respond to and recover from chemical threat attacks through innovative research, development, and transitions of capabilities.

Objectives

- **Develop national chemical defense architecture**
- **Enhance rapid recovery from chemical attacks**
- **Develop pre-event assessment, discovery, and interdiction capabilities for chemical threats**
- **Minimize loss of life and economic impact from chemical attack**
- **Enhance the capability to identify chemical attack sources**

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Some Guiding Principles

- DHS program addresses non-medical challenges
- Strive to engage the interagency in developing strategy
- Strive to utilize existing infrastructure
  - Recognize DoD "specialties" in this area
- Technology demos will down-select from all potential technology candidates

Critical Enablers

Binding interagency agreements

Definition of agency roles/responsibilities

Security classification guidance

Homeland Security

Chemical Threats

- **Chemical warfare agents (CWAs)**
  - Mustard (HD)
  - Nerve agents (G, V)
  - Have seen previous terrorist use (Aum Shinrikyo)
- **Toxic industrial chemicals (TICs)**
  - Large array of materials
  - Reasonably accessible
  - Accidents have caused numerous casualties (Bhopal)
- **Non-traditional agents (NTAs)**
  - Not TICs

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Program Structural Elements

Analysis: Program activities which provide fundamental knowledge that shapes problem understanding

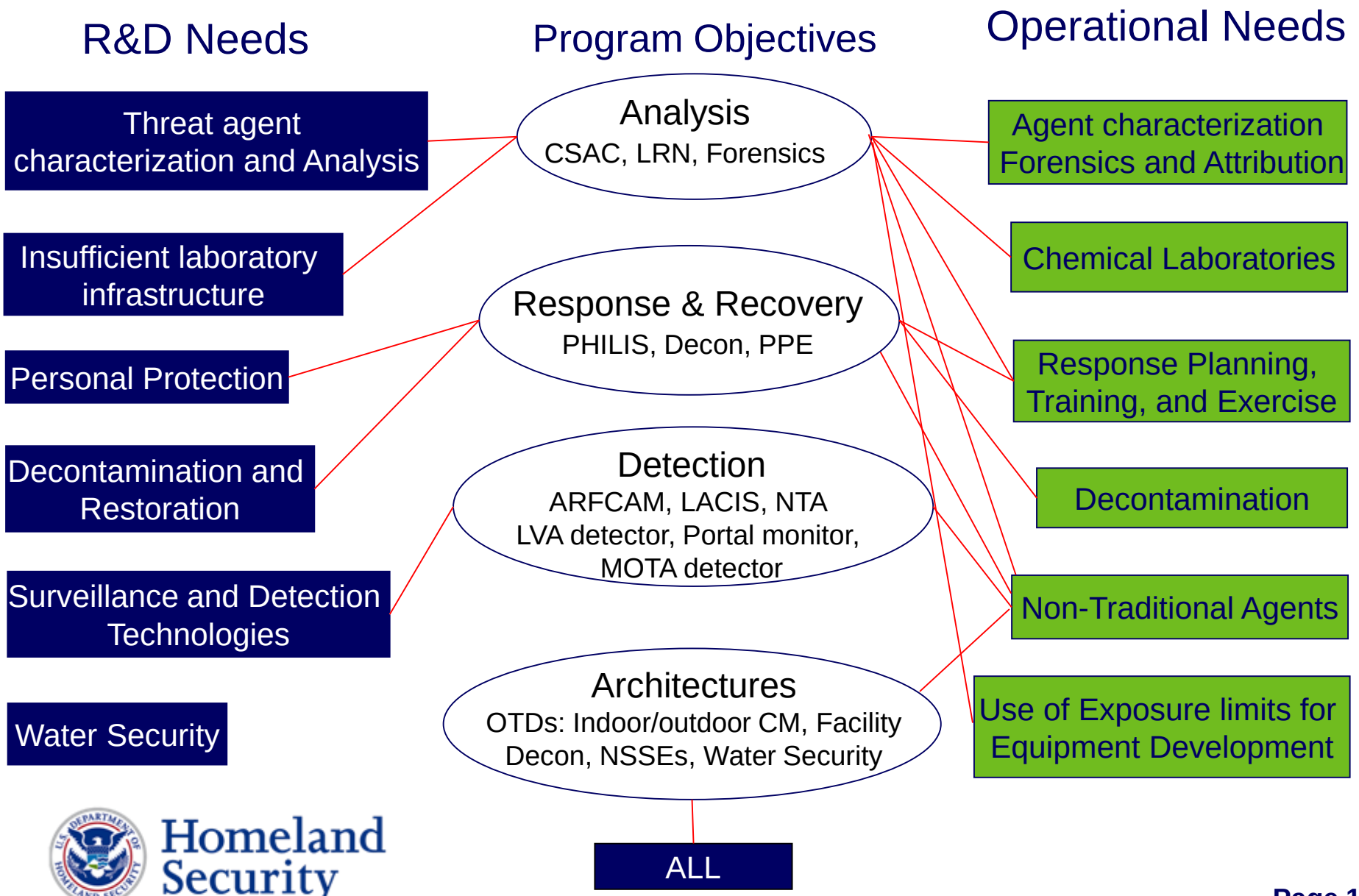
Architectures: * System studies to define problem and outline potential solutions
* Operational technology demonstrations

Detection: Programs which develop and demonstrate solutions to promote situational awareness

Response/Recovery: Programs which develop solutions to enhance return to normal state

Homeland Security

Linkage of Program Objectives to Needs



Homeland Security

Program Area Projects

Analysis

Chemical Security Analysis Center

Forensics

Laboratory Response Network

Detection

Rapid Facility Monitor (ARFCAM)

Hand-held detector (LACIS)

LVA Surface Contamination Monitor

Architecture

Indoor Countermeasures Study

Outdoor Countermeasures Study

Facility Decontamination OTD

NSSEs Deployable Systems OTD

Water Security OTD

Response & Recovery

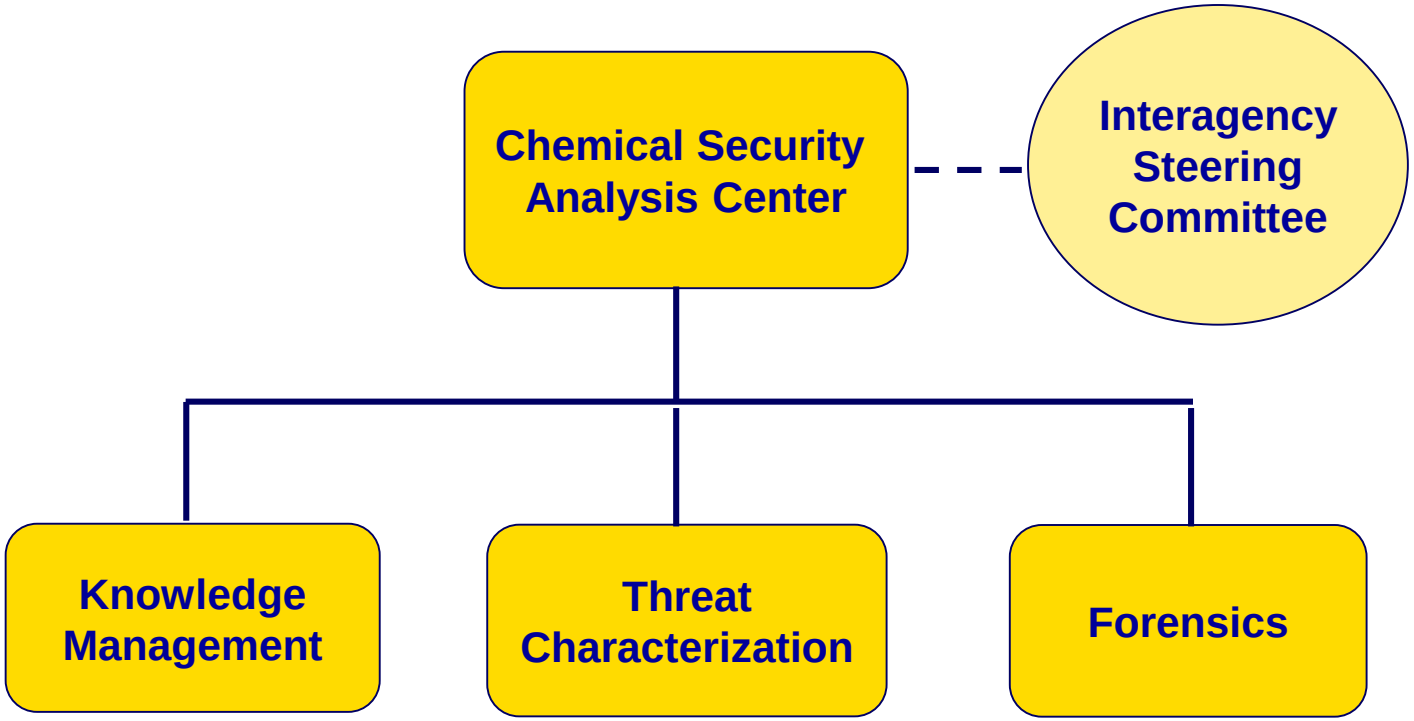
Mobile Lab (PHILIS)

Personal Protective Equipment

Decontamination

Homeland Security

Analysis - Chemical Security Analysis Center



- Threat info
- Expert analysis
- Reach-back

- Properties
- Toxicology data
- Agent Fate data

- Attribution determination
- sigs, protocols, & analysis
- Support participant labs

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Analysis - Chemical Environmental Lab Response Network

Description:

- *Organized process for the sampling and analysis* of very large numbers of environmental samples containing highly toxic chemicals.
- The CLRN will be populated by laboratories qualified by an *interagency-agreed accreditation* process.
- CLRN will include *triage laboratories for analysis of unknown samples* potentially containing highly toxic chemicals such as classical chemical agents.
- Support incident response through rapid analysis of samples from chemical release events as well as potentially toxic samples of suspect origin.

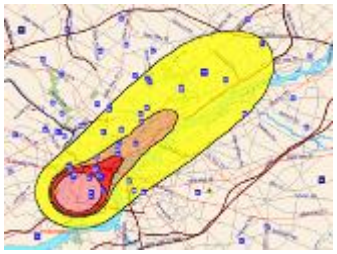
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Architecture - Systems Studies

- ***Initial Focus***
  - Top-level risk and consequence assessments
  - Broad range of chemical agents [CW, TIC/TIM, Low-volatility Agents (LVA)]

- ***Studies will provide***
  - Matrix of impacts
  - Assessment of current, available technologies to detect & recover

- ***Studies will be used to***
  - Guide program prioritization
  - Establish functional requirements for technology & systems
  - Develop defensive system objectives
  - Develop performance metrics



Large Outdoor TIC Release



Water Supply Contam

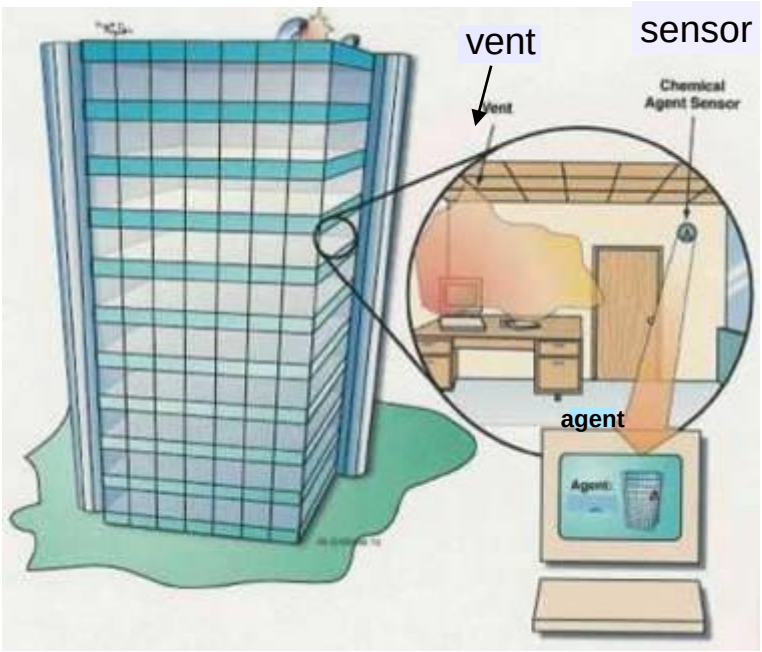


Indoor Release

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Detection - Autonomous Rapid Facility Chemical Agent Monitor (ARFCAM)

***Objective*: Develop, demonstrate, and commercialize a networked capability to detect, and notify of, presence of up to twenty toxic chemical hazards for facility protection**



Challenges:

- *Selectivity* for target agents and against common backgrounds
- *Wide dynamic range*: IDLH to PEL
- *Speed:* target 15 sec (IDLH) / 15 min (PEL)
- *System cost*

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Detection - Lightweight Autonomous Chemical Identification System (LACIS)



***Objective*: Develop, demonstrate, and commercialize a networked responder capability to detect and quantitate up to twenty toxic chemical hazards to assess a scene for contamination and provide guidance on PPE use**



Challenges:

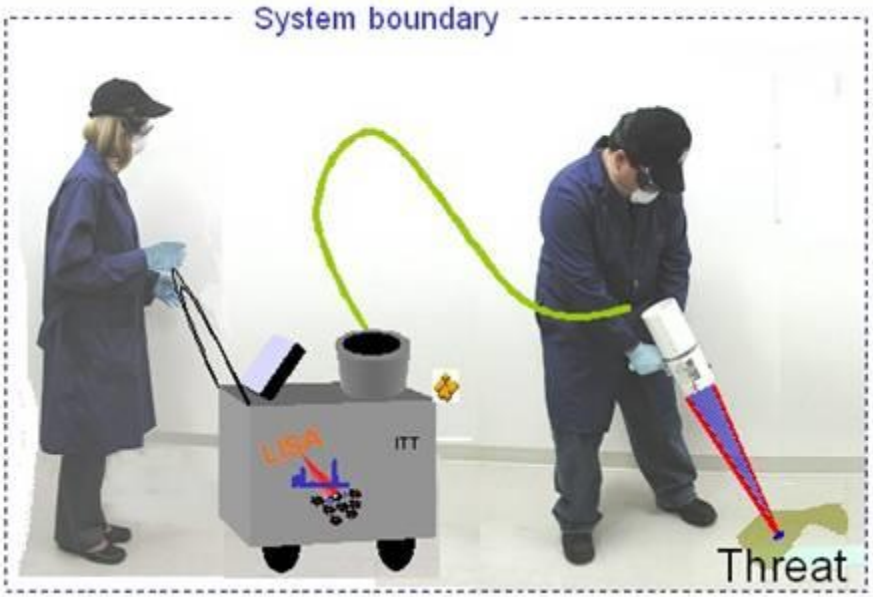
- *Selectivity* for target agents and against common backgrounds
- *Wide dynamic range*
- *Adequate performance in hand-held*
- *System cost*



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Detection - Low Volatility Agent Surface Contamination Monitor

***Objective*: Develop, demonstrate, and field a transportable capability to detect the presence of highly persistent chemical agent**



Challenges:

- *Selectivity* against surface backgrounds
- *Sensitivity*
- *Area analysis speed*

We anticipate initiating a program to develop sensor for warning of LVA dissemination in FY06.

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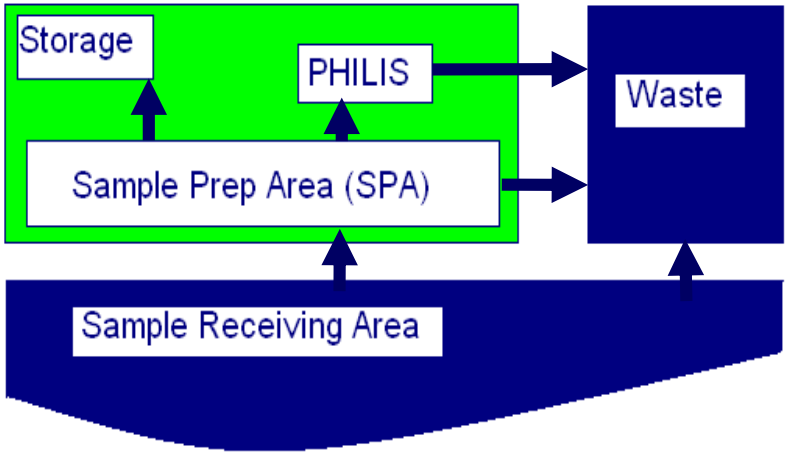
Response & Recovery - Portable High-throughput Integrated Laboratory ID System

Objective: **Develop, demonstrate, and field a rapidly deployable capability for high-throughput analysis of environmental samples to assess scene of contaminated area and facilitate restoration**



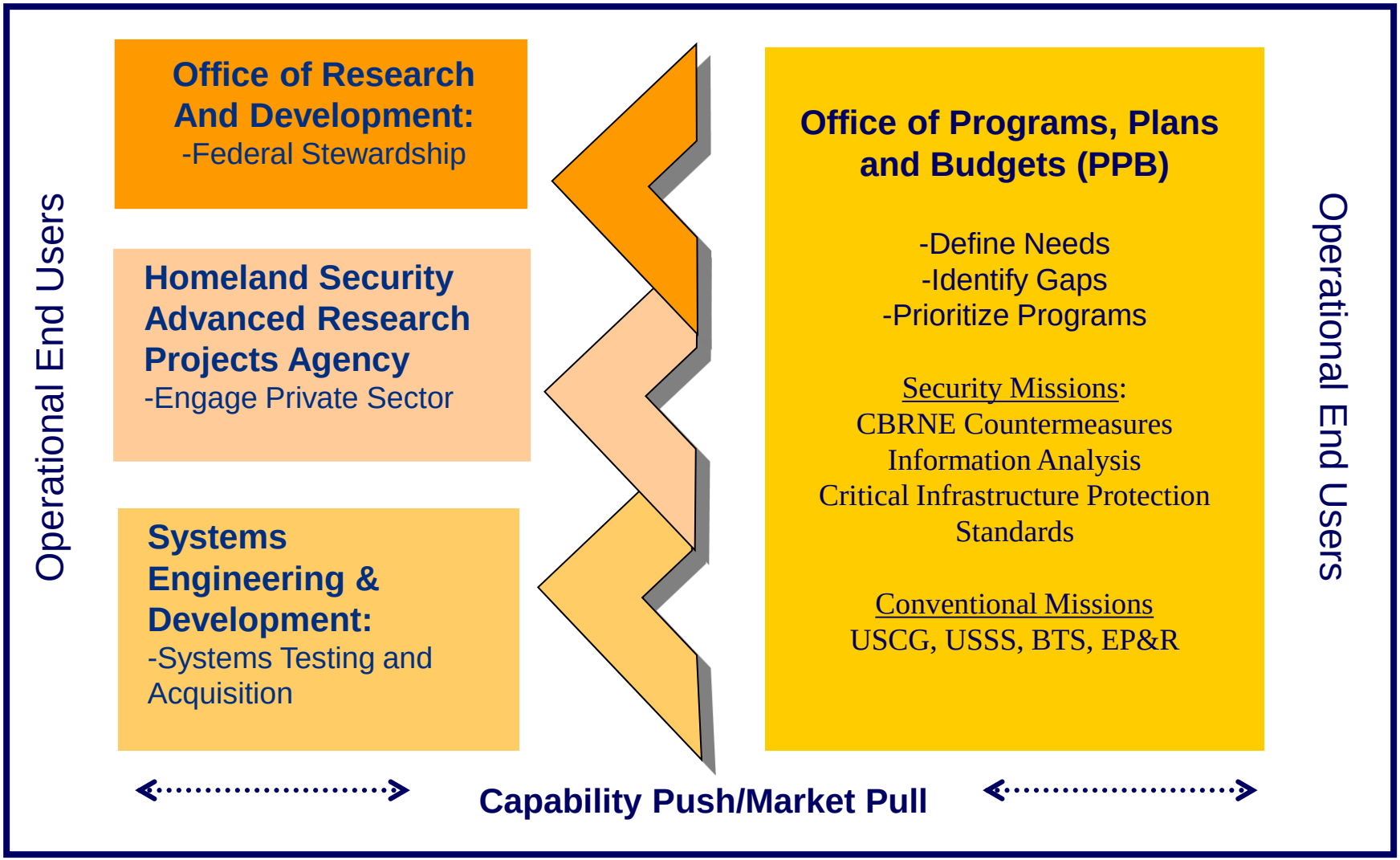
Challenges:

- *Sample load management*
- *Broad set of background matrices*



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Research, Development, Testing and Evaluation (RDT&E)



Homeland Security

HSARPA Solicitations

Past BAA:

- Detection systems for bio & chem countermeasures
- Bio-informatics & assay development

Current BAAs:

- Instantaneous bioaerosol detector systems (IBADS)
- Food Biological Agent Detection Sensor (FBADS)

Past SBIR solicitations:

- Chem-bio sensors employing novel receptor scaffolds
- Advanced low cost aerosol collectors for surv & …

For more information see www.hsarpabaa.com

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U.S. DEPARTMENT OF
HOMELAND SECURITY

Rapid Automated Biological ID System (RABIS)

- **Continuous, Fully Autonomous Operation with 2 Minute or Shorter Sample Intervals Including Latency**
  - **~250K Samples per Year**
- **Broad Agent Coverage > 20 Agents**
  - **Spore, Vegetative Cell, Toxin, DNA Virus, RNA Virus**
- **Limit of Detection (LOD) of 100 Organisms per Liter of Air**
  - **LOD of 0.05 nanograms per Liter of Air for Toxins**
- **System False Alarm Rate of No More than Once per Month**
  - **Goal to Reduce System False Alarm Rate < 1 Year**
- **Cost of Ownership**

  - Acquisition cost (quantities of 100) of ≤ $50K/unit

  - Operation costs of ≤ $20K/yr (maint., parts, consumables)





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Instantaneous Bio-Aerosol Detector Systems (IBADS)

- ***TTA-1: Biological Fast Aerosol Countermeasure System (BioFACS)***
  - Extremely low cost system for the nearly instantaneous detection of biological aerosols at higher level of detection

- ***TTA-2: Biological Confirmation and Detection System (BioCADS)***
  - Integrated trigger-confirmation capability that will have extremely low cost of operation

- ***TTA-3: Volumetric Bio-Aerosol Detection Systems (VBAIDS)***
  - Volumetric bio-aerosol sensors capable of monitoring large indoor and semi-enclosed outdoor spaces





TTA -1 & TTA-2 are higher priority,
TTA-3 subject to availability of fund.

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Instantaneous Bio-Aerosol Detector Systems (IBADS)

BioFACS

- Trigger < 1 min, goal of 15 seconds
- Acquisition cost target of < $10K, with <$1000 as an optimal goal in quantities of 1,000

BioCADS

- 5 min or less for confirmation, trigger speed is goal
- Acquisition cost target of < $25K, with <$1000 as an optimal goal in quantities of 1,000

VBAIDS

- trigger <2-3 min, goal <1 min
- Acquisition cost target of < $50K, with low O&M costs

All- ROC curves for

- 1000, 10,000 and 100,000 CFU(PFU)/Liter of air (Spores, vegetative bacteria, RNA and DNA Viruses)
- 0.5, 5 and 50 ng/Liter of air for toxins

Homeland Security

DEFENSE THREAT REDUCTION AGENCY

DTRA

Making the World Safer

Defense Threat Reduction Agency Science and Technology Programs

S&T Initiatives to Shape the Future
Session IV

NDIA DoD Technology Conference
Bridging the Gap: Technology for Future Warfighters

Dr. Mark Byers
April 21, 2005

DTRA is the Department of Defense's expert for reducing WMD threats

The National Strategy to Combat Weapons of Mass Destruction identifies three pillars in protecting the United States:

- Nonproliferation
- Counterproliferation
- Consequence Management

The Department of Defense created DTRA as a combat support agency to be the center of excellence in combating WMD. The three pillars are integral to DTRA's mission.

WMD can include conventional and disruptive threats



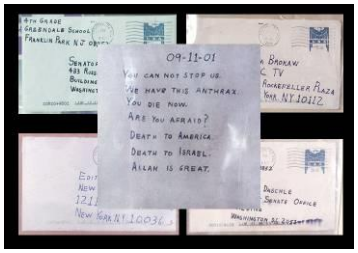
Nuclear Weapons

. . .difficult to acquire, devastating in use



Chemical Weapons

. . .cheap and easy to make



Biological Weapons

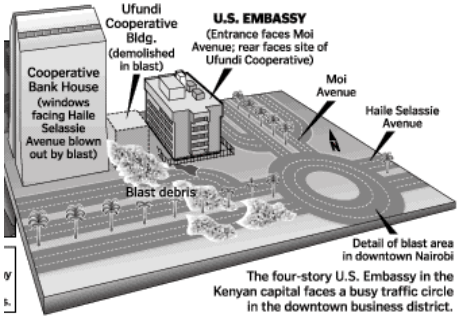
. . .use available technology and are potentially catastrophic



Radiological Devices

. . .dangerous to assemble with high contamination impact





WMD High Yield Explosive Devices

... can assume many forms, quickly made, quickly dispersed, potentially catastrophic

Toxic Industrial Chemicals/Materials (TIC/TIM)

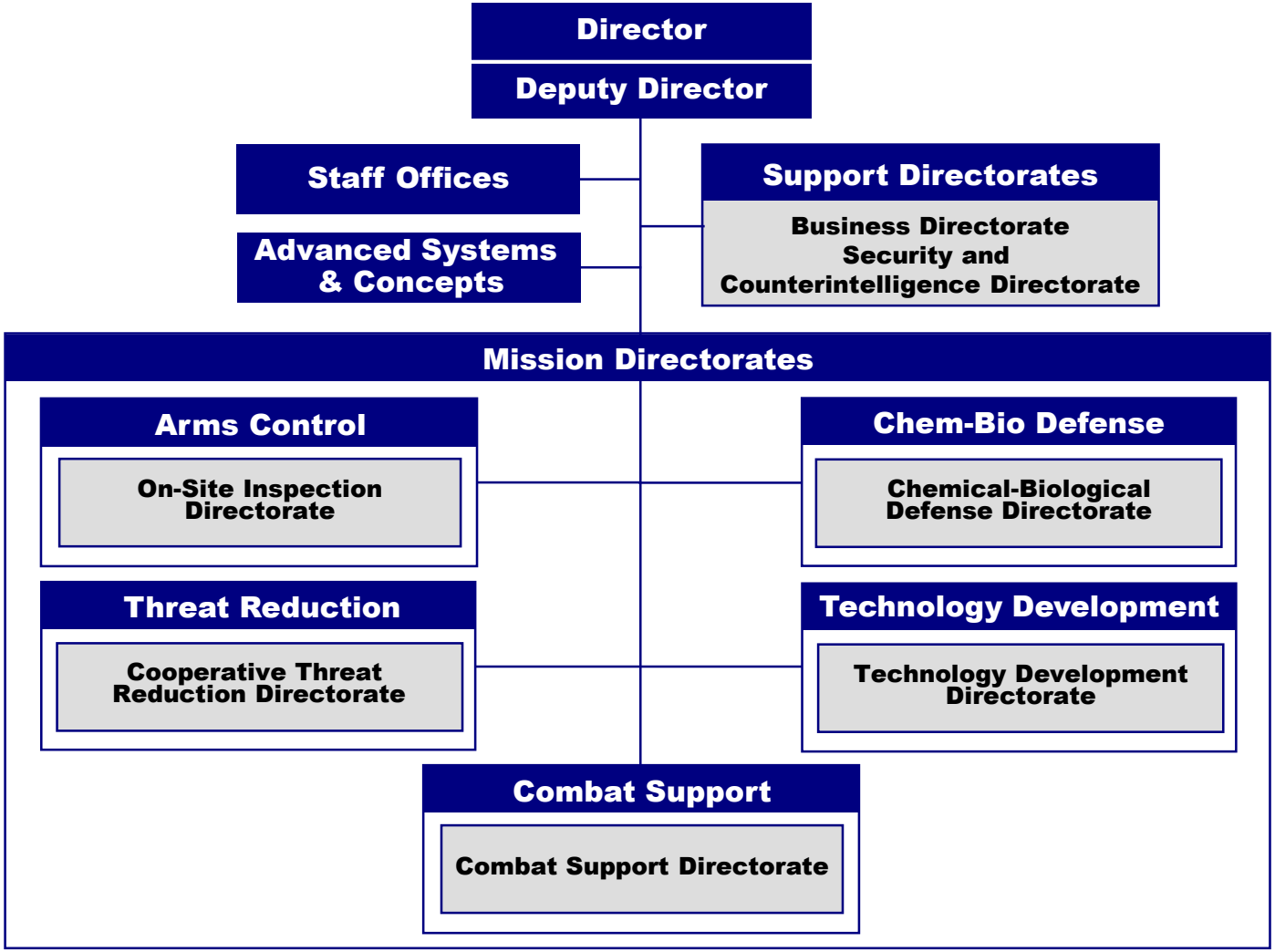
… commonly transported throughout the country on a daily basis



DTRA

Making the World Safer

DTRA is organized according to mission functions



DTRA S&T Goals

Conduct research, develop tools and systems and transition technologies

- Understand WMD threats and potential effects
- Deny enemy sanctuary for WMD
- Defeat WMD threats with minimal collateral effects
- Protect against WMD effects

Programs

Operational Applications

- Modeling and Simulation Integration
- Targeting Support
- Consequence Assessment
- Arms Control Technology
- Operational Support Technology

System Applications

- SOF Technology Support
- Special Projects
- Hard Target Defeat
- WMD Counterforce Applications

Chemical Biological Defense

- Medical Science and Technology
- Physical Science and Technology
- Transition

Nuclear Technology

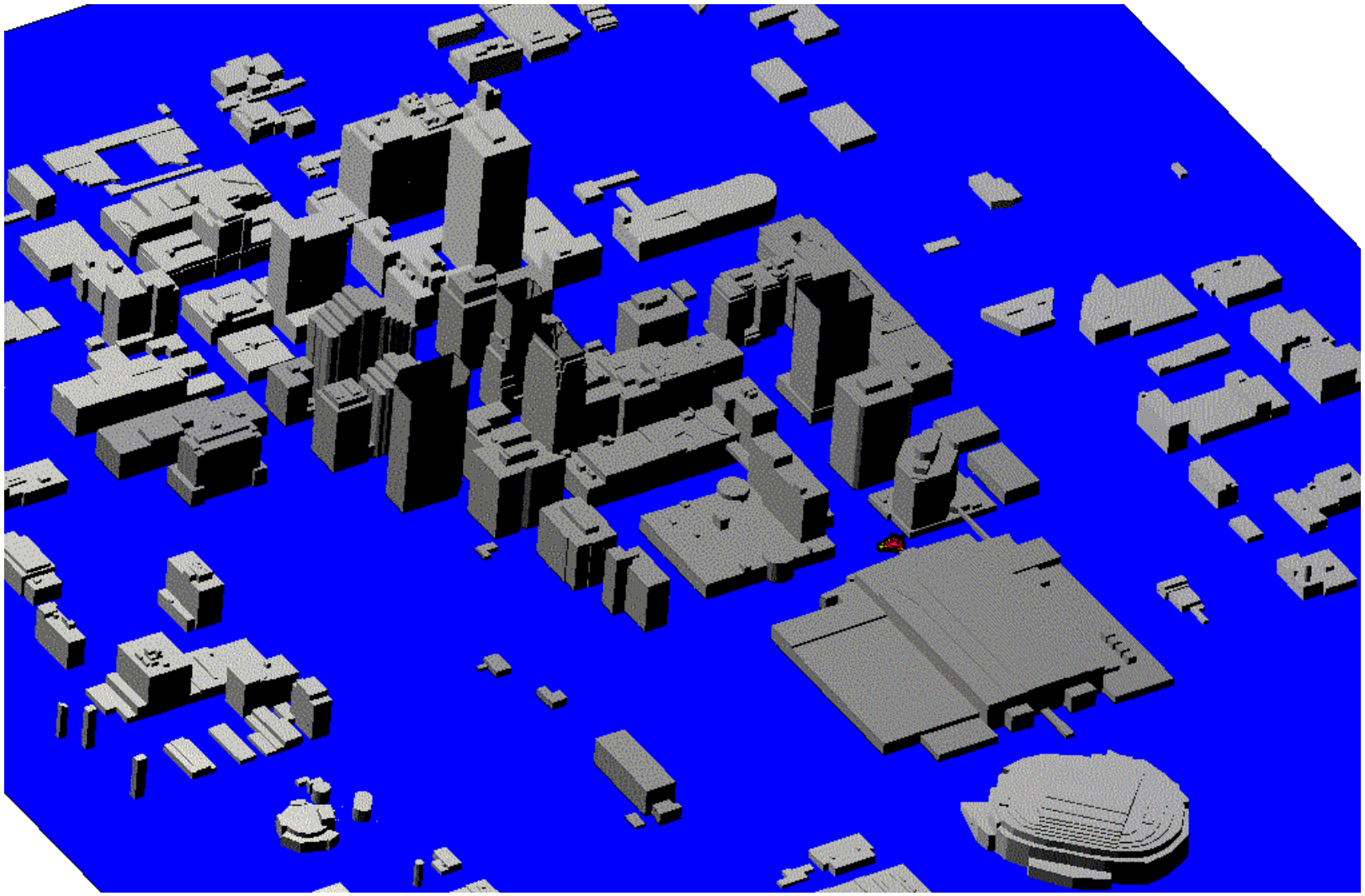
- Radiation Hardened Microelectronics
- Detection Technology
- Nuclear Assessments
- Nuclear Environments

Operational Applications
Major Objectives & Initiatives

- Expand Hazard Prediction Capabilities
- Build Underground Targeting and Analysis Tools
- Develop Blast Protection Technologies
- Integrate WMD Tools



Plume Model



Programs

Operational Applications

- Modeling and Simulation Integration
- Targeting Support
- Consequence Assessment
- Arms Control Technology
- Operational Support Technology

System Applications

- SOF Technology Support
- Special Projects
- Hard Target Defeat
- WMD Counterforce Applications

Chemical Biological Defense

- Medical Science and Technology
- Physical Science and Technology
- Transition

Nuclear Technology

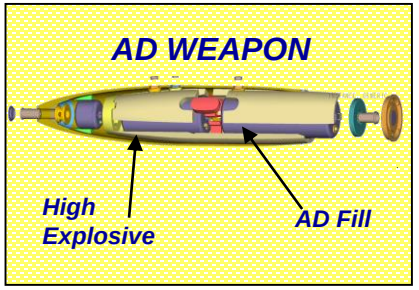
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System Applications
Major Objectives & Initiatives

- Develop combat assessment technologies
- Demonstrate Agent Defeat/Deny/Disrupt (AD3) technologies
- Develop Special Operations Forces focused capabilities.
- Complete Thermobaric Advanced Concept Technology Demonstration (ACTD)
- Develop tools and processes to characterize Underground Facilities (UGFs)





Tunnel Defeat Testing



Programs

Operational Applications

- Modeling and Simulation Integration
- Targeting Support
- Consequence Assessment
- Arms Control Technology
- Operational Support Technology

System Applications

- SOF Technology Support
- Special Projects
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- WMD Counterforce Applications

Chemical Biological Defense

- Medical Science and Technology
- Physical Science and Technology
- Transition

Nuclear Technology

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Nuclear Technology

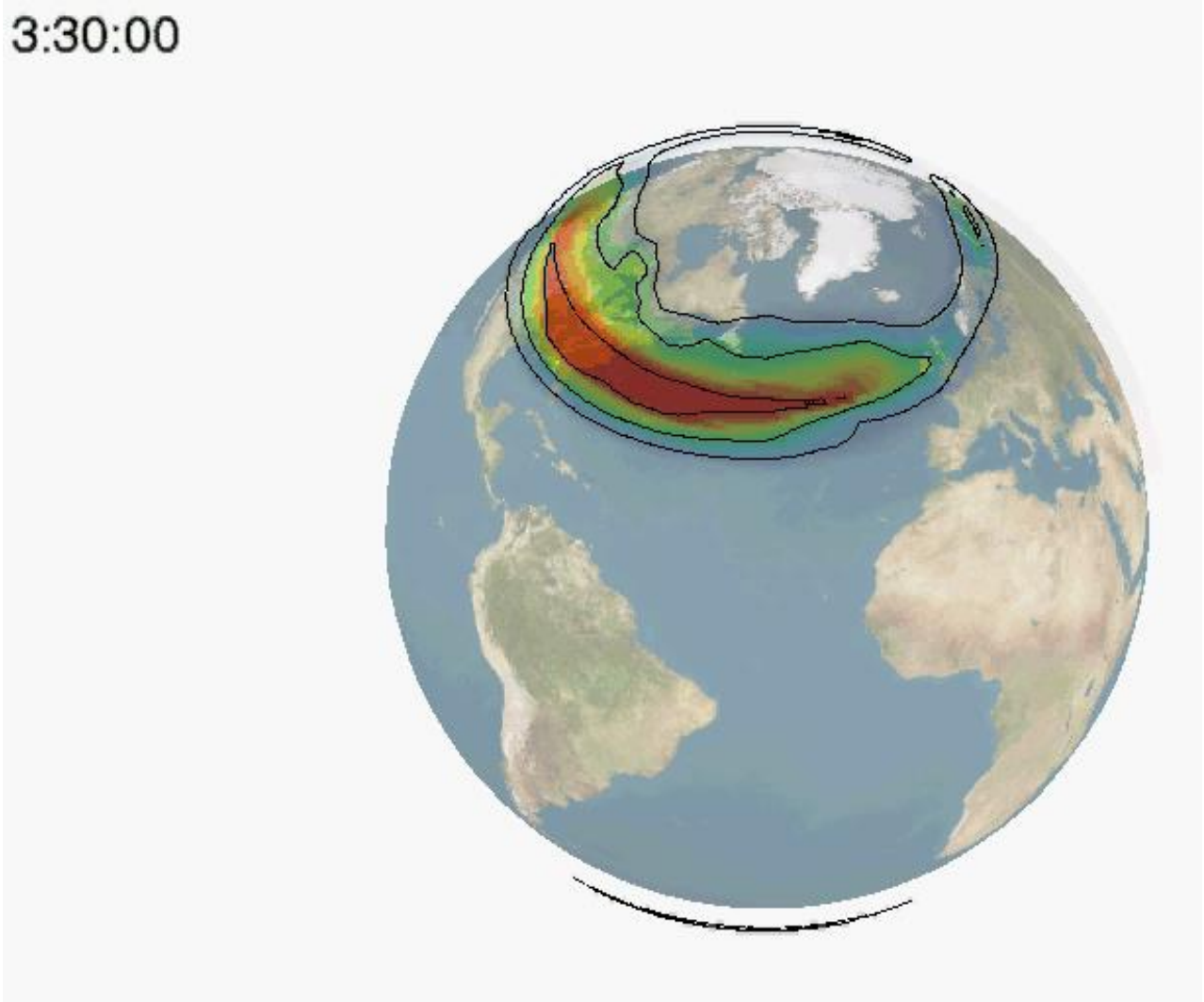
Major Objectives & Initiatives

- Complete Rad Hard microelectronics 0.15 micron technology
- Develop multi-platform radiation detection systems
- Provide EM hardness assessments and technologies to DoD system managers and develop technologies to harden systems
- Modernize nuclear weapons effects models for 21st century applications





Integrated Space Weather Prediction Model



Programs

Operational Applications

- Modeling and Simulation Integration
- Targeting Support
- Consequence Assessment
- Arms Control Technology
- Operational Support Technology

System Applications

- SOF Technology Support
- Special Projects
- Hard Target Defeat
- WMD Counterforce Applications

Chemical Biological Defense

- Medical Science and Technology
- Physical Science and Technology
- Transition

Nuclear Technology

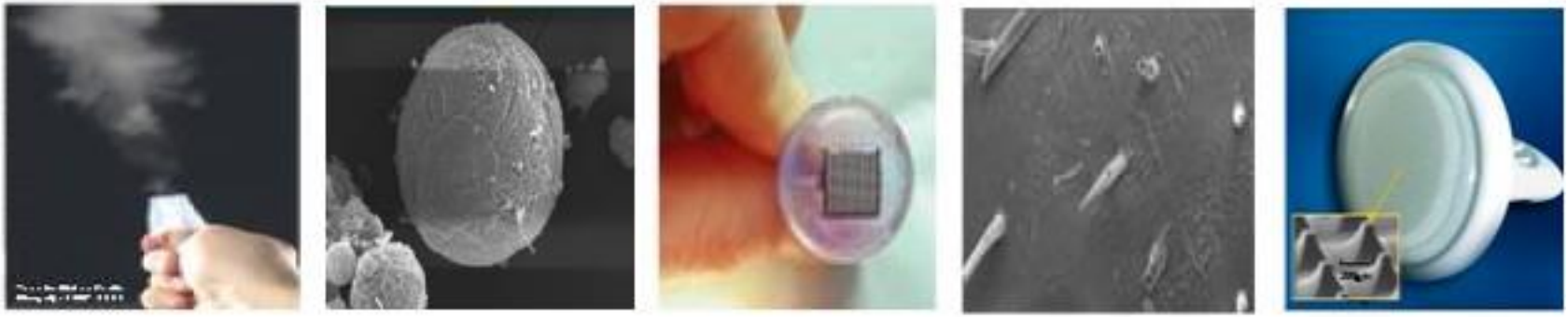
- Radiation Hardened Microelectronics
- Detection Technology
- Nuclear Assessments
- Nuclear Environments

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Making the World Safer

Chemical Biological Defense
Medical Science and Technology
Major Projects

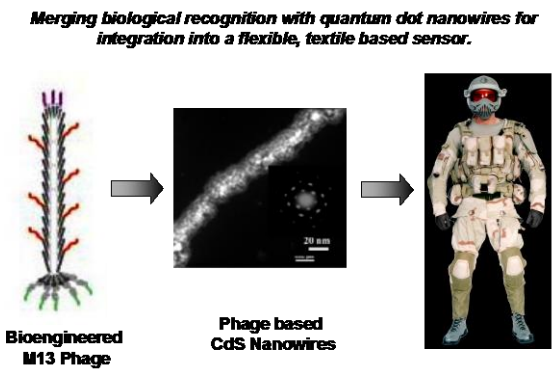
- DNA/molecular vaccines with common vaccine platform and interchangeable antigen cassettes
- Multiagent vaccines and needle-less delivery systems
- Anti-sense ribonucleic acid (RNAi) analog therapeutics
- Recombinant catalytic nerve agent bioscavenger pretreatment
- Improved therapeutics for nerve agent intoxication effective against broader array of agents
- Effective therapeutics against viral and toxin agents
- Better understanding of physiological and behavioral effects of low dose exposure to nerve agents



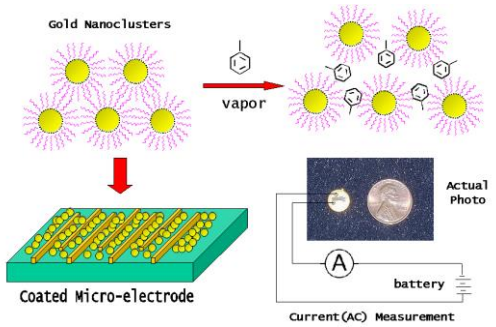
Variety of needle-less methods under development

Chemical Biological Defense
Physical Science and Technology
Major Objectives & Initiatives

- Develop point and stand-off biodetection capabilities
- Develop self-decontaminating materials
- Demonstrate advanced aerosol protection technologies and advanced closures integrated into Joint Service Lightweight Integrated Suit Technologies
- Develop modeling and simulation and battlespace management tools
- Develop decontaminates that permit rapid restoration of combat power
- Complete Agent Fate and Low-Level toxicology studies of classical agents and develop approaches for Non-Traditional Agents



Quantum dot nanowire textile sensor



Gold nanocluster sensor

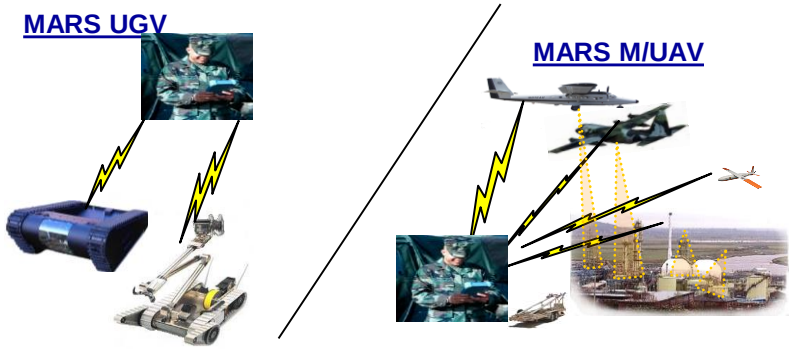
DTRA
Making the World Safer

Chemical Biological Defense - Transition
Major Objectives & Initiatives

- Support accelerated fielding of operational capabilities (technology, Concepts of Operation and automation tools) to Combatant Commanders and Services through Advanced Concept Technology Demonstrations (ACTDs) and Advanced Technology Demonstrations (ATDs)
  - CBRN Unmanned Ground Reconnaissance ACTD
  - Military Application in Reconnaissance and Surveillance ATD
  - Chemical Biological Training System ATD

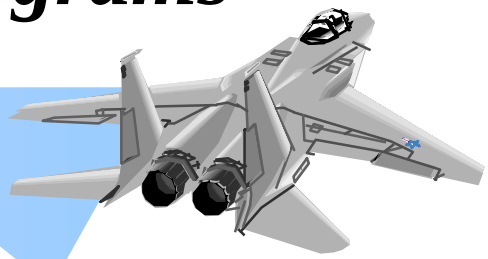


CUGR Components: JNBCRS; PacBot UGV; UGV Control Panel



Military Application in Reconnaissance **and Surveillance**

DTRA Science & Technology Programs



Focused research and development

Transitioned through training, exercises, demonstrations and testing

Supporting warfighters and responders





Making the World Safer

Aviation S&T Strategic Plan (ASSP 2005)



The Vision and Technology Plan for the Integrated Manned and Unmanned Rotorcraft Fleet

Mr. Ned Chase
Chief, Platform Technology Division
Aviation Applied Technology Directorate

Why - An S&T Strategic Plan Now?

- The “rate of change” in DoD is rapid and accelerating
- Aerial capabilities must support the transformation goals
- Promote Unity of Vision, Mission, and Community
- Provide clear, consistent strategy to DoD Leadership with buy-in from the Stakeholders.
- Provide a clear vision of success and a “path ahead” to include:
  - Strategic Goals
  - Alignment of S&T Strategic Partners
  - S&T Investment Strategy for the Future

We need to Revitalize the Aviation S&T Enterprise

Congressional Testimony on U.S. Rotorcraft Industrial Base

- The U.S. has and is continuing to lose jobs and revenue to foreign competition in the VTOL aerospace market.
- NASA and the DoD have made significant reductions in rotorcraft science and technology funding over the past few years that has a direct correlation with U.S. industry's global competitiveness.
- Beside Europe, new centers of rotorcraft technology and manufacturing capability are developing in India, China, Japan, Korea, and Canada.
- U.S. Military, Homeland Defense, and commercial markets are interdependent. Technologies and economies of scale from each market enable across-the-board development and cost efficiencies.
- The U.S. Government has neglected the rotorcraft sector of the industrial base.

National Crisis Exists!!!

Scope

- **Strategic**: The scope is to include a ***vision for the future*** and the investment strategy and infrastructure needed to achieve the vision.

- **S&T**: The scope is ***S&T only***, and does not include system development, engineering support, or other related business areas.

- **Joint Service VTOL Rotorcraft**: The scope is inclusive of the DoD ***Project Reliance*** responsibility for joint service rotorcraft S&T. The Army is assigned the DoD responsibility for meeting the Joint Service rotorcraft technology requirements.

- **Army Aerial Systems**: The scope includes ***all Army aerial*** vehicle systems, (manned or unmanned; fixed wing or rotary wing, VTOL-CTOL and everything in between) including the platforms, propulsion, associated mission equipment and payload integration, ground support equipment, logistical support, etc. necessary to develop, manufacture, operate, and maintain them.

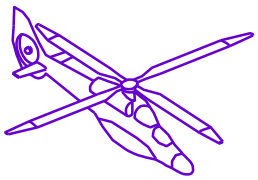
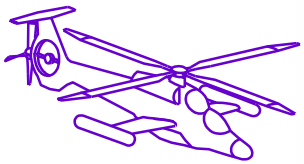
- **Investment Strategy:** The scope covers the direction and strategy for the investment of Aviation S&T funding and the resultant capability transition. It is expected that the ***Strategic Partners*** will align to meet the total set of needs under a ***shared responsibility*** for S&T development. The investment will be prioritized and dependent upon these ***strategic alliances*** to meet the vision.

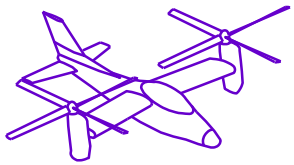
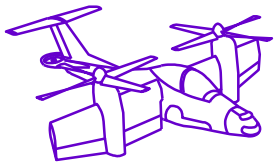
Definition of a Rotorcraft

An air vehicle whose primary means of vertical lift is a rotating airfoil

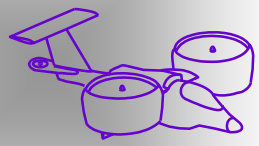
Is This Air Vehicle a Rotorcraft?

Yes

Maybe

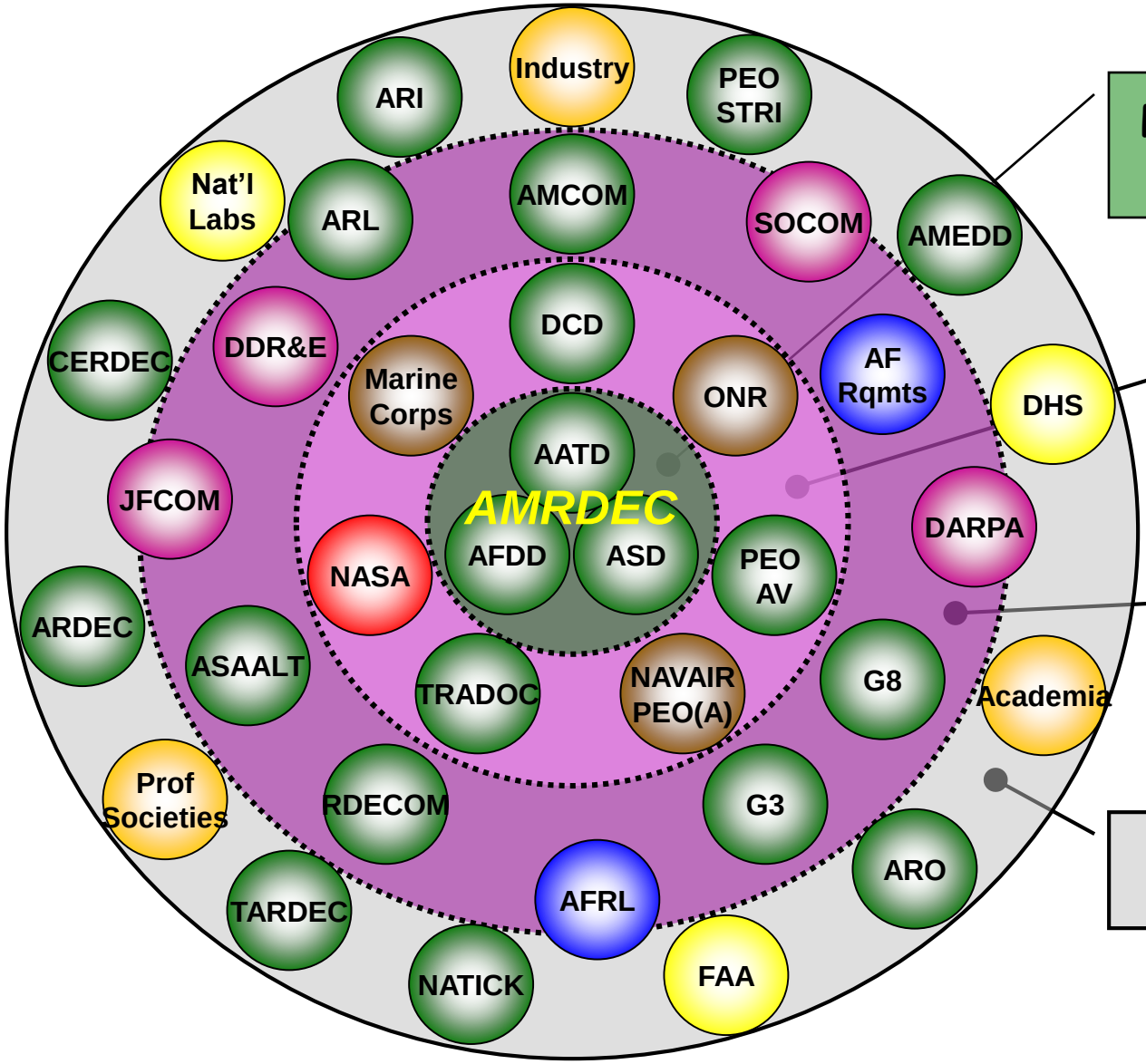

No







Aviation S&T Enterprise



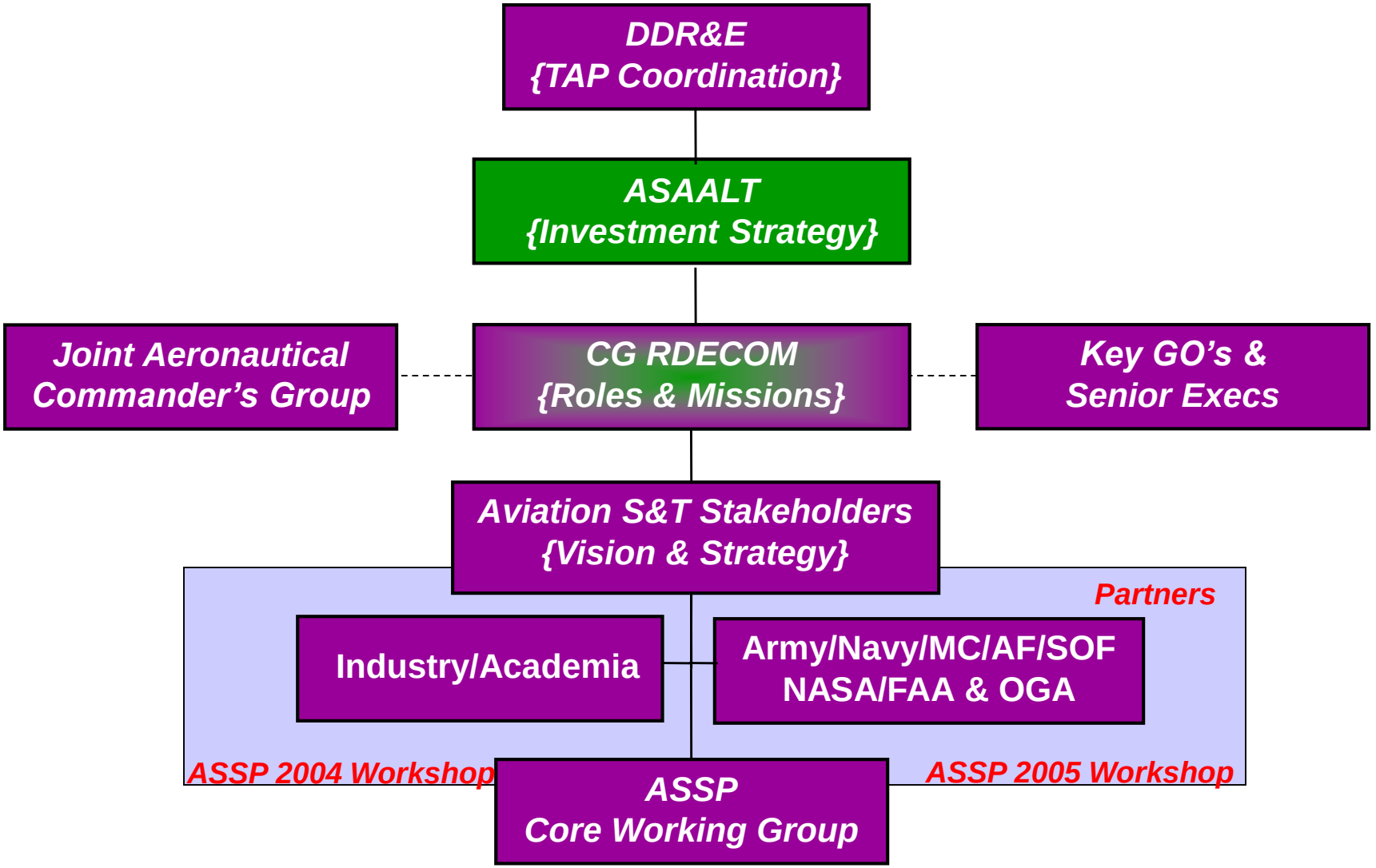
Project Reliance Lead

Core Working Group IPT

Stakeholders

Partners

Coordination Chain



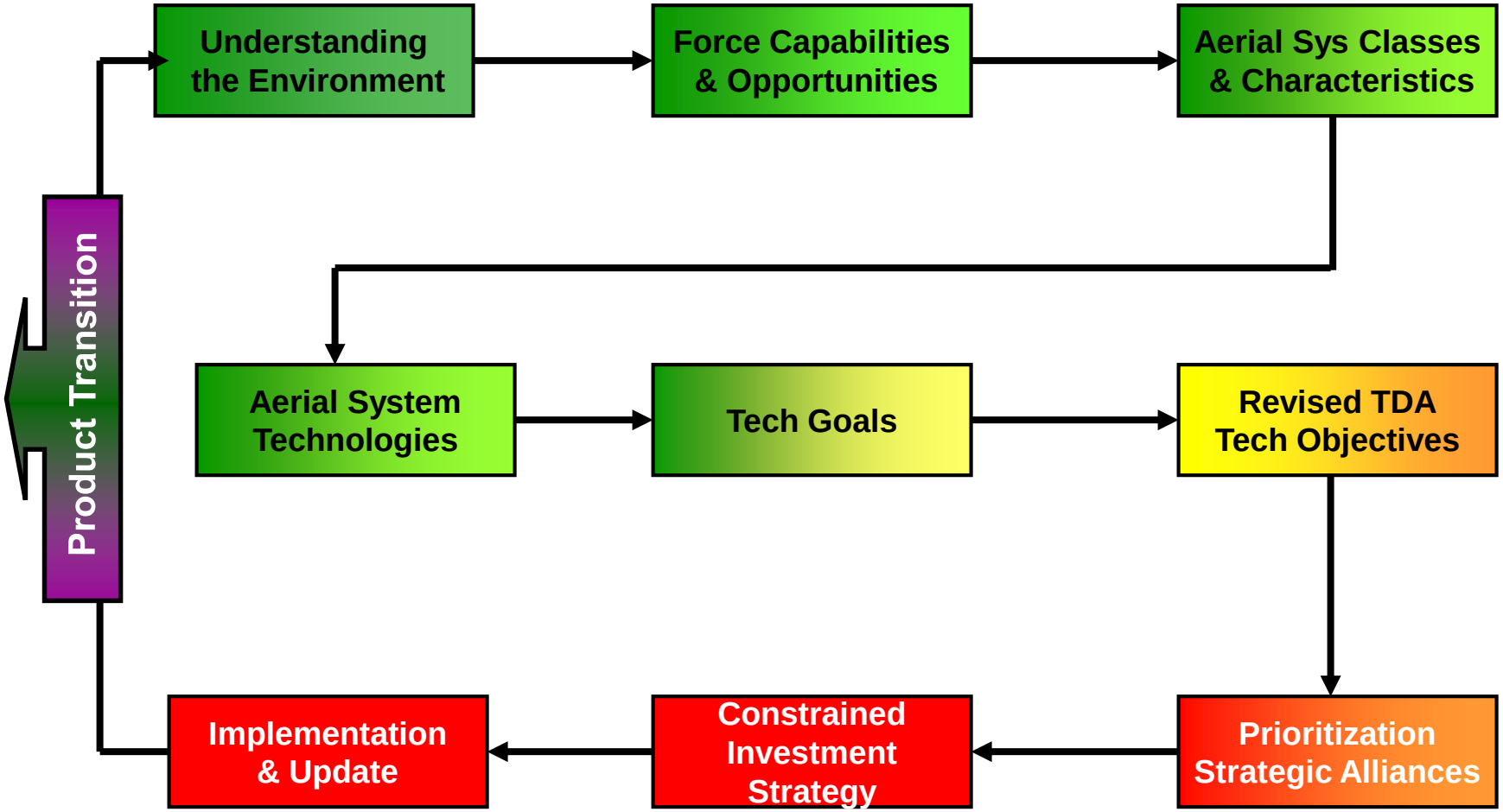
ASSP Products

- **Vision of Future Joint Aerial Capabilities**
  - Based on Relevant DOD/Joint Service/Army Vision/Transformation Objectives
  - Time Phased
  - Forward Thinking
- **Distillation of Joint Operational Capabilities and Derived Technical Objectives**
  - Needed to achieve the vision
  - Measurable Goals/Objectives
- **Joint Investment and Partnering Strategy - Create the Technical Capabilities**
  - Definitive Roadmaps to Goals (End-states)
  - Allocation of responsibilities/assets for achievement
  - Ownership and committed Stakeholders
- **Known and Communicative National Community United in Support of the Strategy**
  - Regular forum for dialogue and developing common understanding / positions
  - Clubhouse and membership (team building / integration)
- **Infrastructure Plan**
  - People
  - Facilities
  - Partnerships
  - Policies & Processes

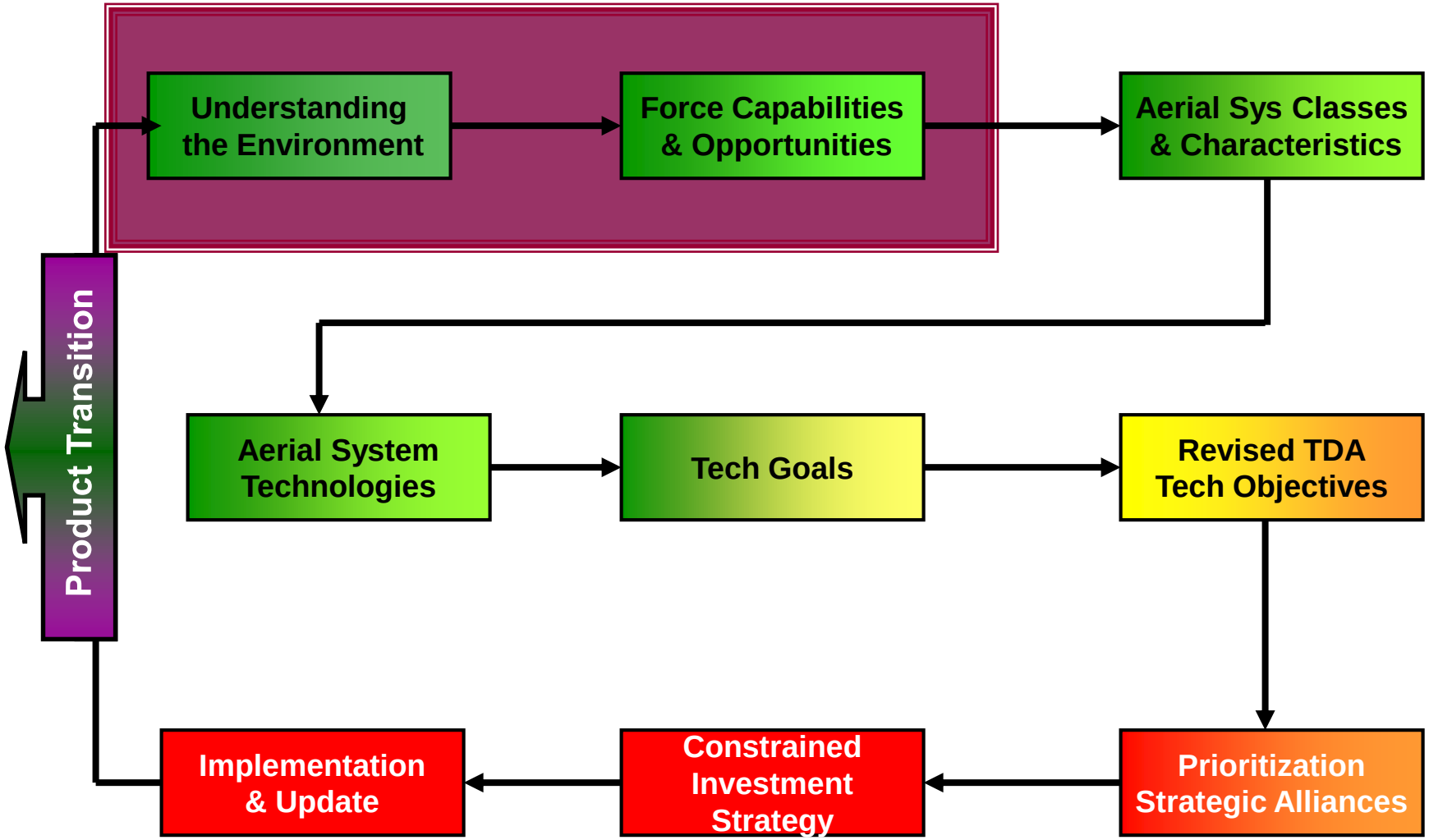
ASSP PROCESS

Flow and Status

ASSP Process Flow



Understanding the Environment



Understanding the Environment

Key Briefings

Key Reference Documents

Review And Analyze

"The Environment"
Summary Brief

Vision

Affordable, full spectrum Joint Services VTOL rotorcraft systems and Army Aerial Systems with transformational capabilities that include/are:

- **–Interoperable: Joint, Interagency, Multi-national**
- **–Reduced operation and support footprint consistent with employment echelon**
- **–Operations 24/7 in near all-weather and complex terrain**
- **–Responsive global deployment and worldwide employment**
- **–Full spectrum, distributed survivability/lethality**
- **–Synergistic teaming of manned and unmanned systems**
- **–Vertical maneuver of mounted forces**
- **–Platform attributes consistent with joint air-ground operations**
- **–All VTOL/VSTOL Marine Corps aviation**

Focused National S&T Program & Infrastructure

Joint Force Capability Linkage

Derived from ASSP Context and DoD Capability Documents

Future Naval Capabilities

Marine Corps Strategy 21

FCS ORD JROC Approved

FCS KPPs

Future Naval Capabilities

- Autonomous Operations
- Capable Manpower
- Advanced Capability Electric Systems
- Fleet/Force Protection
- Knowledge Superiority & Assurance
- Littoral Antisubmarine Warfare
- Littoral Combat & Power Projection
- Missile Defense
- Organic Mine Countermeasures
- Total Ownership Cost Reduction
- Time Critical Strike
- Warfighter Protection

TRADOC FOCs

- Strategic Responsiveness & Deployability
- Battle Command Construct
- Sensor Fusion
- Mounted/Dismounted Maneuver
- Non-Line of Sight Lethality
- Line of Sight / Beyond Line of Sight
- Lethality for Mounted / Dismounted
- Air / Ground Operations
- Survivability
- Maneuver Support
- Maneuver Sustainment
- Training and Leader Development
- Human Engineering

Joint Vision 2020

Secretary of Defense Priorities

TRADOC PAM 525-66

Force Operating Capabilities

Human Functions Analogy

Basic Functions

- Sense
- Understand
- Decide
- Communicate
- Move
- Team
- Shoot / Attack
- Protect / Defend
- Care / Feed / Fix
- Learn / Adapt



Force Capability Areas

Derived from ASSP Context and DoD Capability Documents

Future Naval Capabilities

Marine Corps Strategy 21

FCS ORD JROC Approved

FCS KPPs

Sense, Assimilate & Understand
Network Comm / Battle Command
Expeditionary Deployment
Maneuver
Maneuver Support
Cooperative / Collaborative Teaming
Offensive Effects / Lethality
Force Protection / Survivability
Sustainment / Logistics
Proficiency / Adaptability / Training

Joint Vision 2020

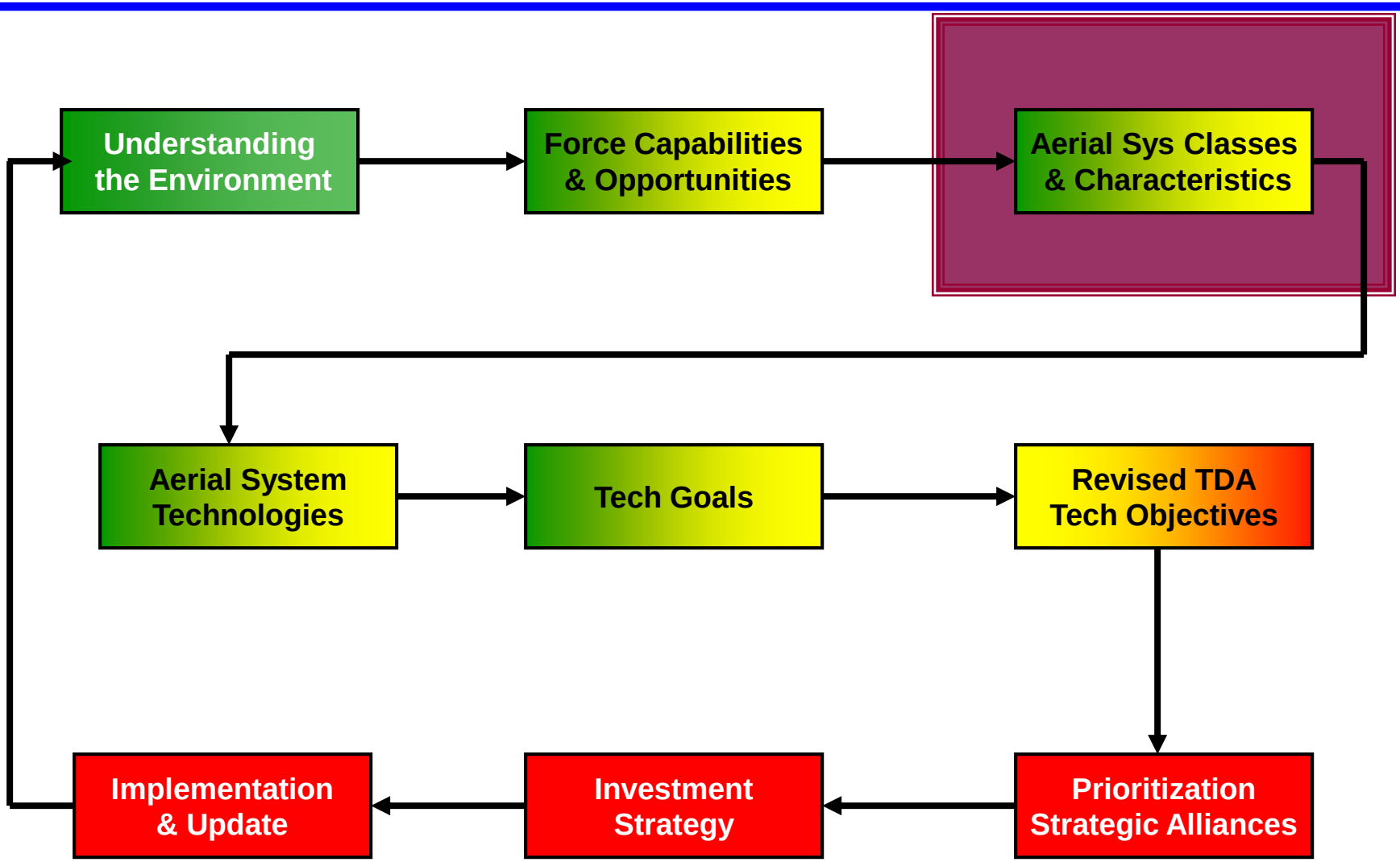
Secretary of Defense Priorities

TRADOC PAM 525-66

Force Operating Capabilities

Go To Force Capability Brief

Aerial System Classes & Characteristics



Air Vehicle Classes*

Operational Considerations

Aviation Core Competencies:
- Reconnaissance
- Attack
- Lift (Utility & Cargo)
- Command & Control

Favorable Cost of Ownership:
- Research & Development
- Procurement
- Sustainment
- Force Structure

Echelon:
- Team - to - Theater

Payload:
- Passengers
- Weight & Cube
- Mission Equipment

Technical Considerations

Aviation System Characteristics:
- Size
- Weight
- Speed
- Type
- Endurance
- Reliability
- Severe Geographical & Environmental Extremes

* Includes Manned and Unmanned Systems

Current-to-Future -- Force Trends

- Full Spectrum Operations
  - Future Force Equals Joint Force Operations
  - Strategic, Operational & Tactical Mounted Maneuver Concepts
- UAVS Integrated Throughout The Force
  - Proliferation of UAVS In Near-Mid-Far Term
  - Intelligence Systems In Production & Being Fielded
  - Maneuver Systems For Reconnaissance, Attack, Utility & Cargo In Concept Development
  - Capable Of Doing "The Dirty, Dull & Dangerous"
- Multi-Mission / Multi-Purpose Platforms
  - Trend Is For Fewer Manned Platforms In The Future
  - Goal - Reduced Procurement and Support Costs
  - Operational Benefits Might Not be As Clear (More w/Less)
- Greater Emphasis On Reducing O&S Costs
  - Future Operations Extended to Support Peacekeeping efforts
  - Extended Ranges Significantly Increase RW Flight Hours
  - Mix Of RW & FW Required To Meet Force Demands

Aerial Platform Trends*			
USA:	21:20	5%	↓
RW:	12:9	25%	↓
UAV:	3:8	160%	↑
FW:	6:3	50%	↓
USMC:	11:9	19%	↓
RW:	9:7	22%	↓
UAV:	2:2		↔
USN:	6:3	50%	↓
RW:	6:2	66%	↓
UAV:	0:1	100%	↑
USAF:	4:4		↔
RW:	3:3		↔
UAV:	1:1		↔

* SOF Numbers Included In Service Totals

How to Classify Aerial Systems?

What drives the technology that should be worked on?

- **Mission ?**
- **Configuration?**
- **Specific Characteristics?**
- **Payload?**
  - **Weight**
  - **Dimensions**
- **Take-Off Gross Weight (TOGW)?**

Biggest Driver of Technology Needs:

Overall Dimensions (Size),

for which TOGW is a good surrogate

Generic Aerial System Classes

Technical View





	TOGW (lbs)	
Class 0	<8	
~ Army FCS	Class I	8-32
	Class II	33-200
	Class III	201-1500
	Class IV	1501-7500
	Class V	7501-75000
	Class VI	> 75000

Unmanned

Manned & Unmanned











Class 6 - Aerial System

Typical Missions: LOTS, STOM, VERT REP, VMM, SOF
Attributes: Cargo/Troop/Vehicle delivery system with rapid load/unload capability. Internal & Ext loads. Land based, Shipboard capable. {Growth land & sea based}. Aerial refueling capable. Supports Expeditionary Ops. Net ready.
Aircraft Type: VTOL or Hybrid
Manned System: Dual pilot / Single pilot operable
Echelon: UE/MEF/MEB/CSG/ESG
Environment: World-wide Perf (SL/103 – 6K/95+)
TRL 6: 2015

Notional System Characteristics

Gross Weight:	**>75,000 lbs**
Design Life:	**10,000 Hrs (6000 Eng)**
Payload:	**20-25 Tons**
Range:	**500-1000 km**
Speed:	**>175 kts**
Autonomy:	**Level 4-6**
Sustainment:	**90% OR Rate**
Footprint:	**UE/MEF Consistent**
Survivability:	**Full Spectrum**
Transportability:	**Shipboard**
Self Deployability:	**4000 km**

Shipboard Compatible

Optionally Piloted

Automated Int/Ext Load Mgt & Capture

Advanced Cargo Handling

Class 4 - Aerial System

Typical Missions: Attack, Recon, Utility, VERT REP, SOF
Attributes: Internal & Ext loads. Land & Sea based. Aerial refueling capable. Supports Expeditionary Ops. Net ready.
Aircraft Type: VTOL, Hybrid or FW
Unmanned: ATOL&F in Complex Terrain / OOV
Manned: Single pilot / OPV
Echelon: Av Squadron / MEF/MEB/MEU/CSG/ESG
Environment: World-wide Perf (SL/103 – 6K/95+)
TRL 6: 2015

Notional System Characteristics

Gross Weight:	1501- 7500 lbs
Design Life:	10000 Hrs
MTBC:	3,000 hrs
Payload:	35-65% GW
Endurance:	5-48 Hrs
Range:	100-1000 km
Speed:	100-300 kts
Autonomy:	Level 6-8
Sustainment:	90% OR Rate
Footprint:	UA Consistent (Squadron)
Survivability:	Balanced
Transportability:	C-130, C-17, Class 6

UA CRP

Persistent Stare

Adv Targeting & Tracking

Automated Emergency Casualty Evac

Airborne Netfires

Robotic Wingman

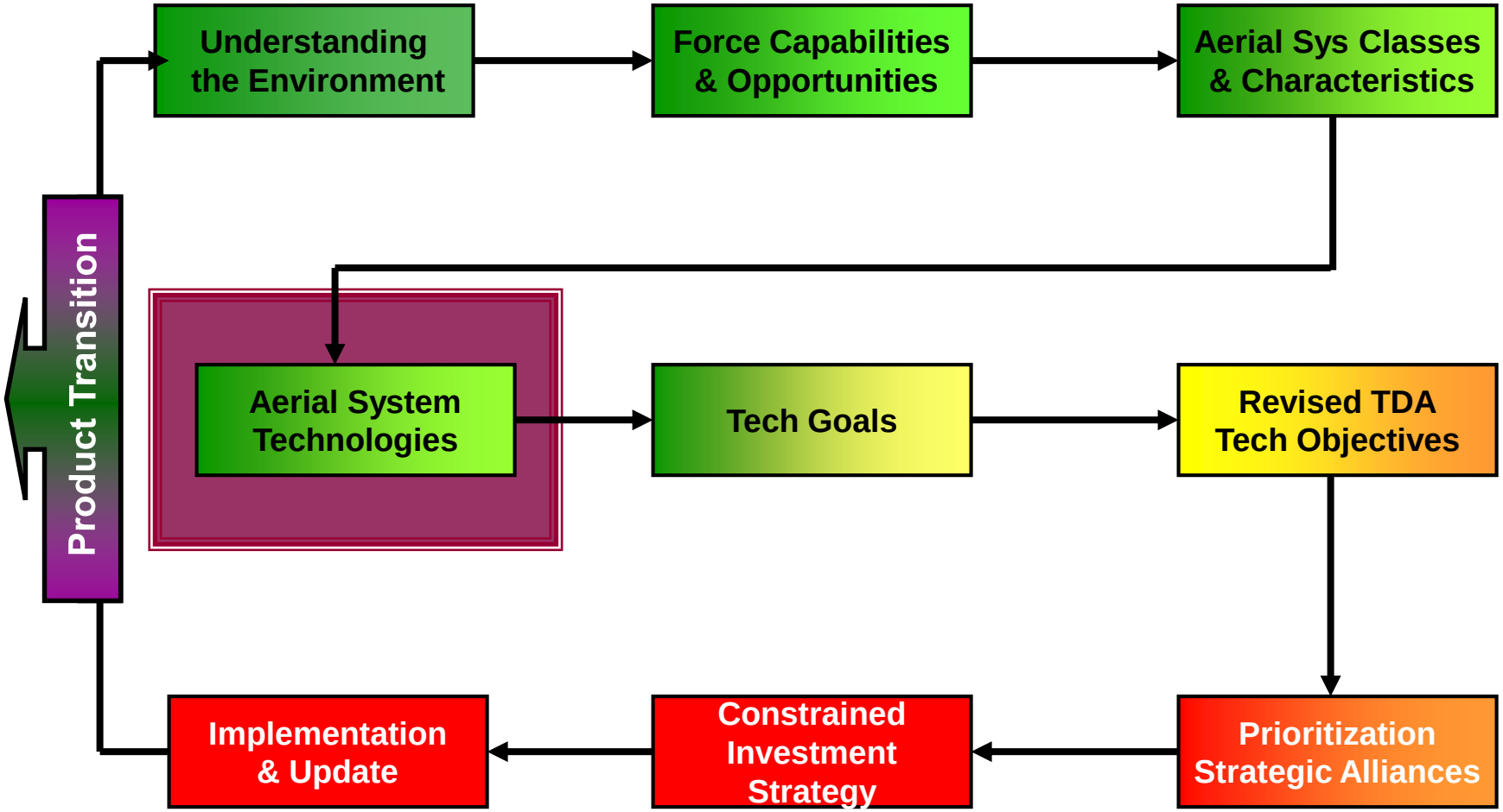
ATA & ATG Engagement

OTM Mine Detection

Force Protection Autonomous Patrols Armed Recon

Autonomous Retail Delivery with Automated Load Mgt & Capture

Aerial System Technologies

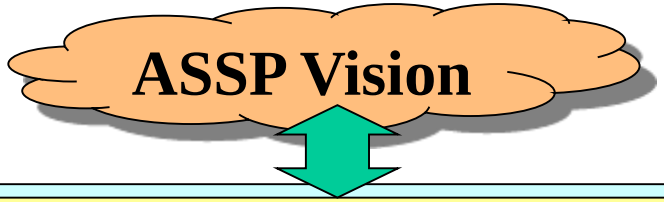


ASSP Aerial Systems S&T Taxonomy Focus & Technology Areas

- **Platform**
  - Structure
  - Force & Moment Generators
  - Vehicle Mgt & Control
  - Subsystems
- **Mission Systems**
  - Engagement and Effects
  - Survivability
  - Teaming, Autonomy & Info Mgmt
  - Human Sys Interface
  - Avionics/Networking
- **Power**
  - Engines & Motors
  - Other Power Sources
  - Drives & Power Transmission
- **Operations Support & Sustainment**
  - Sustainment
  - Flight Operations
- **Systems Analysis and Concepts**
  - Aerial System Concepts Evaluation
  - Analyze System Effectiveness in JIM

Aerial Systems Taxonomy is more than the RWV construct
{Aeromechanics/ Drive Systems/Structures/ Subsystems/Flight Controls}

Taxonomy Relationship



Aerial System Enterprise

Goals for

● Affordability ● Deployability ● Mobility
●Battlefield SA ● Battle Command ● Lethality ● Survivability
● Supportability ● Footprint ● Training

Aerial System

Class Specific Capability Goals

Platform

Power Systems

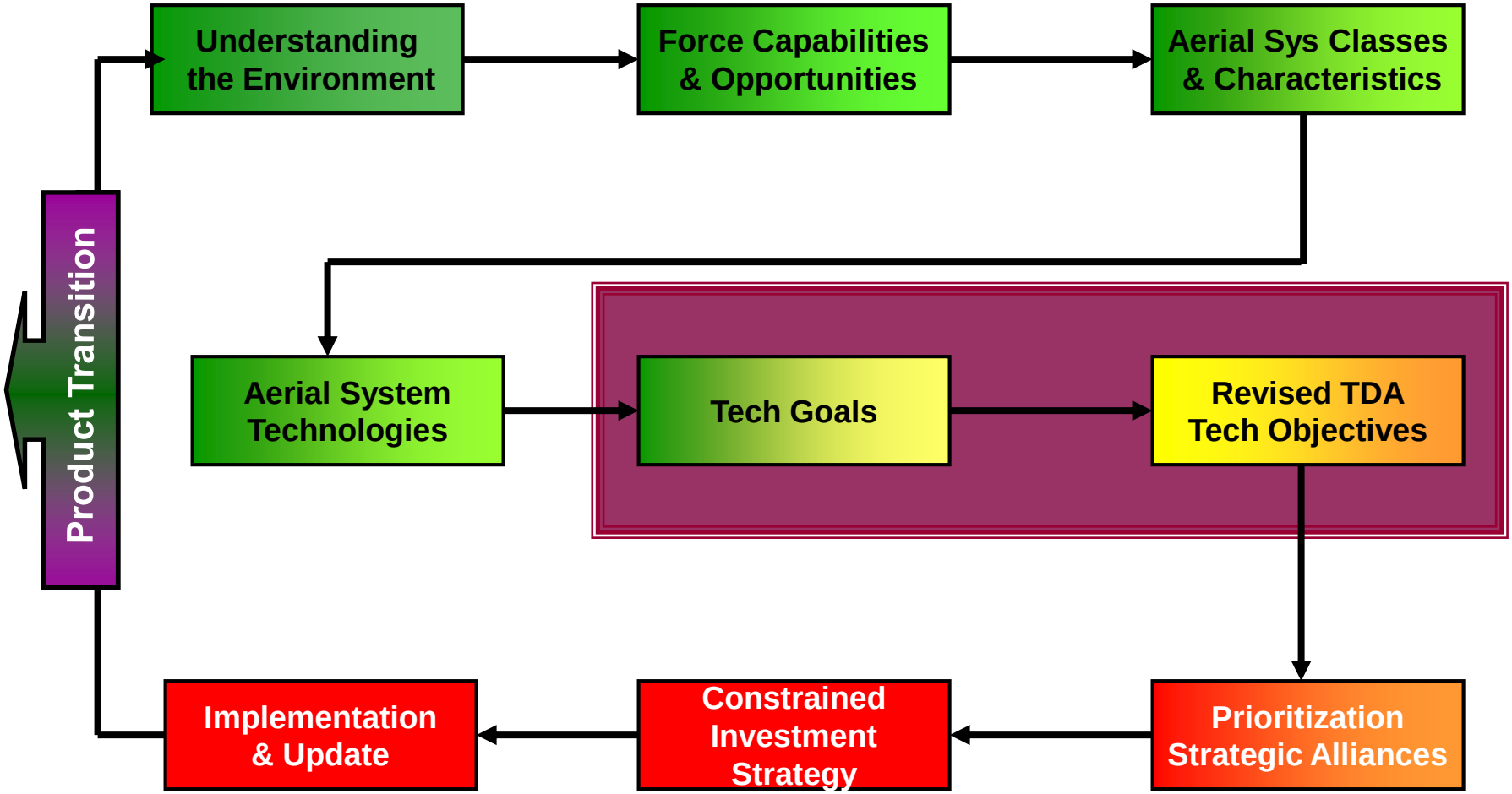
Mission Systems

Ops Support & Sustainment

Systems Concepts & Analysis

● Systems Concepts ● Systems Effectiveness Analysis ● Systems Interactions
Aerial SoS Concepts, Analysis, Interactions

Technology Goals



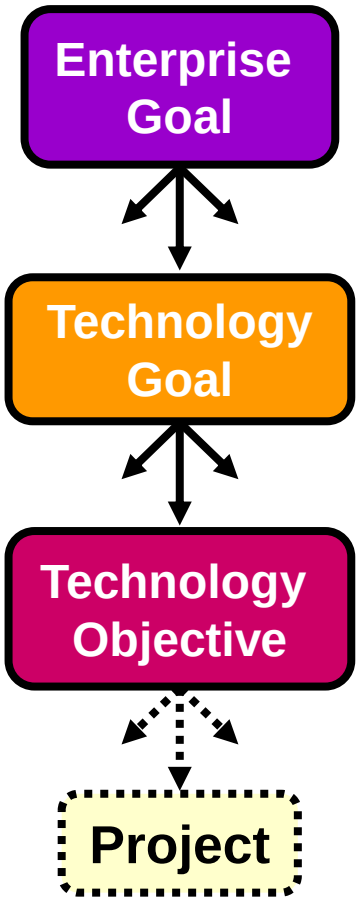
Aerial System Enterprise Goals

Affordability:	50% Reduction in Dev/Prod/O&S Cost
Footprint:	50% Reduction
Deployability:	Brigade in 96 hrs (To be revised)
Supportability:	90% OR
Battle Command:	25% Reduction in response time
Battlefield Situational Awareness:	100% Blue/95% Red within AOR
Lethality:	97% Effects on target
Survivability:	80% Red. in Blue Aerial Systems Losses
Mobility:	3X Improvement in Range/End/Payload
Training:	Equiv. Proficiency @ 1/2 time

Draft

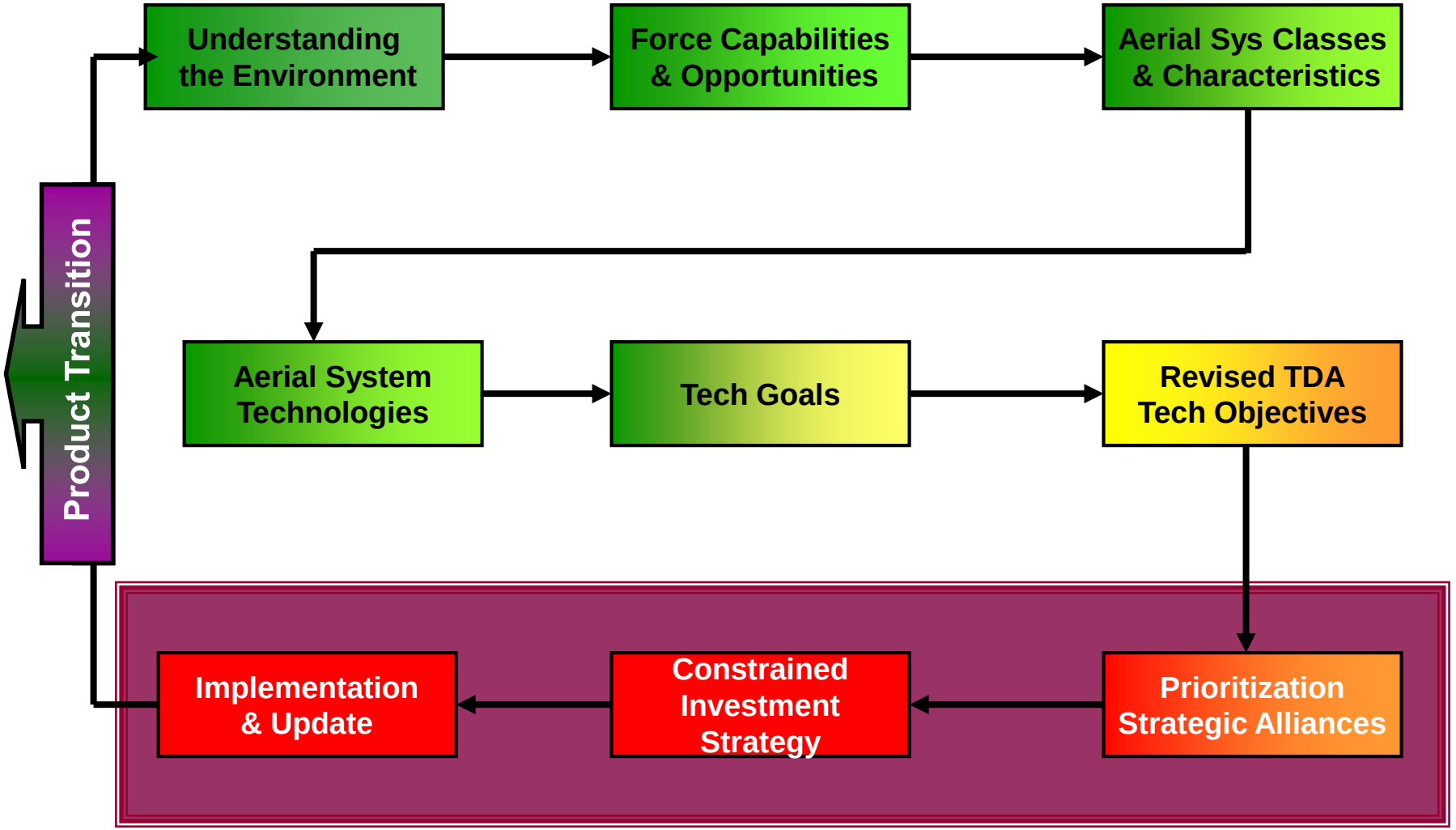
Approach to TDA Connectivity

- The TDA consists of 3 hierarchical levels
  - **Enterprise Goals** (Top Level)
  - **Technology Goals** (Mid Level)
  - **Technology Objectives** (Bottom Level)
- **Enterprise Goals** are to be decomposable into (and connectable) to **Technology Goals**
- **Technology Goals** are to be decomposable into (and connectable) to **Technology Objectives**

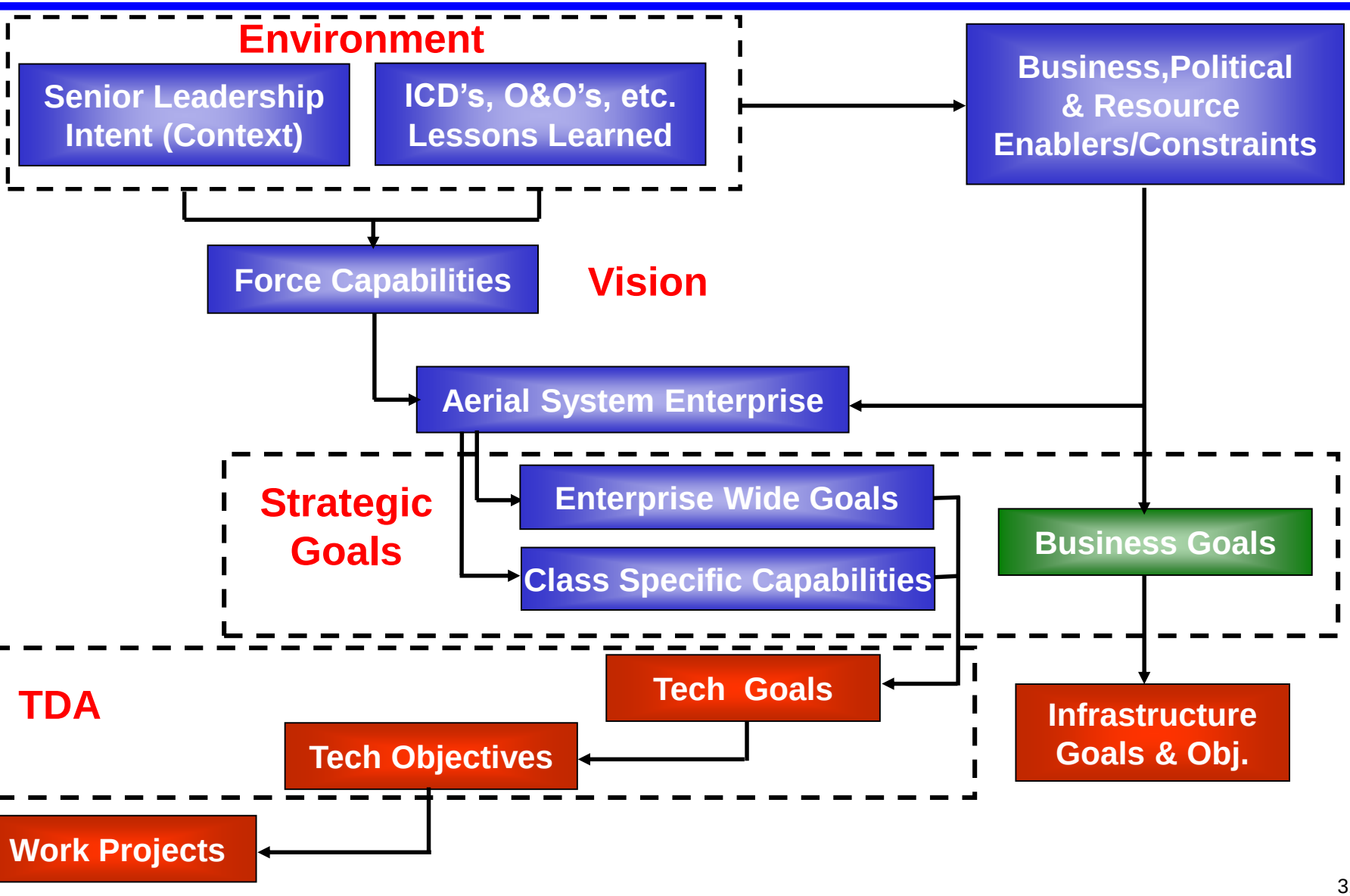


- A **Project** (a/k/a a "Work Package") is the embodiment of one of potentially several approaches to accomplishing a **Technology Objective**

Aerial System TDA
Tech Objectives



ASSP Process Flow
{A Technology & Business Balanced View}



Enterprise Business Issues

- Workforce
  - Depth & Breadth
  - Skills, Discipline, & Age Distribution
  - Utilization & Focus
- Leadership
  - Strategic Focus
  - Objective Decisiveness
  - Roles & Responsibilities Alignment
  - Risk Tolerance
  - Commitment, Enthusiasm, Energy
- Organization
  - % Captured Capability
  - Clear and Non-Overlapping Missions, functions, facilities, & skills
  - Internal and External Competition
  - Reward System - Individual or Team
- Culture
  - Reactive or Proactive
  - Competitive or Cooperative
  - Change Tolerance
  - NIH
  - Component Or Systems Perspective
  - Competition or Sole Source Orientation
- Processes
  - Workload distribution - Overburdening
  - Financial Management
  - Personnel Management
  - Product Transition and Transfer
  - Non-Productive Requirements
- Resources
  - Funding
  - Personnel
  - Facilities (Tools & Equipment)

Strategic Elements Completed

- **Joint S&T Enterprise Definition**
  - Community of Stakeholders & Partners
  - Recognition & Acceptance of Joint Responsibility
  - Promotion & Dialog within the Community
- **Joint Strategic Planning Process**
  - Stakeholders & Partners: Government & Industry
  - Capabilities, Systems, Technologies, & Priorities
- **ASSP Vision Statement**
- **Definition of Aerial System Classes**
  - Joint, Big Picture Context
  - Capabilities and Characteristics Relevant to Each
- **Redefinition of Holistic System Taxonomy**
  - Platform, Power, Mission Systems, Ops Support & Sustainment , Systems Concepts & Analysis
- **Establishment of Holistic Focus & Technology Areas**
- **Enterprise Goals & Derived Technology Goals**

Community, Commitment, Communication

ASSP 2005 – Path Ahead

- **Develop a Tactical Prioritization Process**
  - **Army Aviation Investment**
  - **Follows Strategic Tenets**
  - **Accounts for All the "other" considerations (Organizational Health, Congressional Interest, Technology State & Payoff, etc.)**
- **Develop Strategic Investment Plan**
  - **Enterprise Level Focus to Achieve Technology Goals**
  - **Investment Tenets (Classes,Competencies, etc.)**
  - **Interdependent Partnerships**
- **Develop Framework for Revised Aerial System TDA**
  - **Consistent with Systems Level Taxonomy**
  - **Meets TARA 2004 Tasking**
- **Describe Continuing S&T Planning Activities for:**
  - **Revised TDA Completion**
  - **Developing Technology Roadmaps (Program Plan)**
  - **Conducting & Maintaining Technology Status Assessments**
  - **Addressing Business Practice Improvements**


Questions?

This Briefing is UNCLASSIFIED

Office of Force Transformation

Fighting the Networked Force: Insights from Network Centric Operations Case Studies

NDIA SE&T Conference

Charleston, SC

20 Apr 2005

Lt Col Jack "Ripper" Forsythe

OSD Office of Force Transformation

(703) 696-5769 [DSN 426-XXXX]

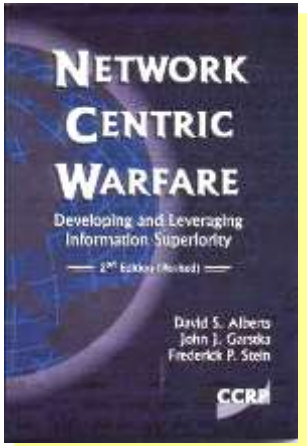
jack.forsythe@osd.mil www.oft.osd.mil

Overview

- Tenets of Network Centric Operations (NCO)
  - Domains of Warfare
  - NCO Value Chain
- Office of Force Transformation NCO Case Studies
- NCO Transformation Process
  - Insights and Challenges

How a Networked Force Operates: Network Centric Operations

Create Information Advantage – Translates into Warfighting Advantage



Info Advantage - Network Forces (Noun & Verb)

Characterized by:

- Information Sharing
- Shared Situational Awareness
- Knowledge of Commander's Intent

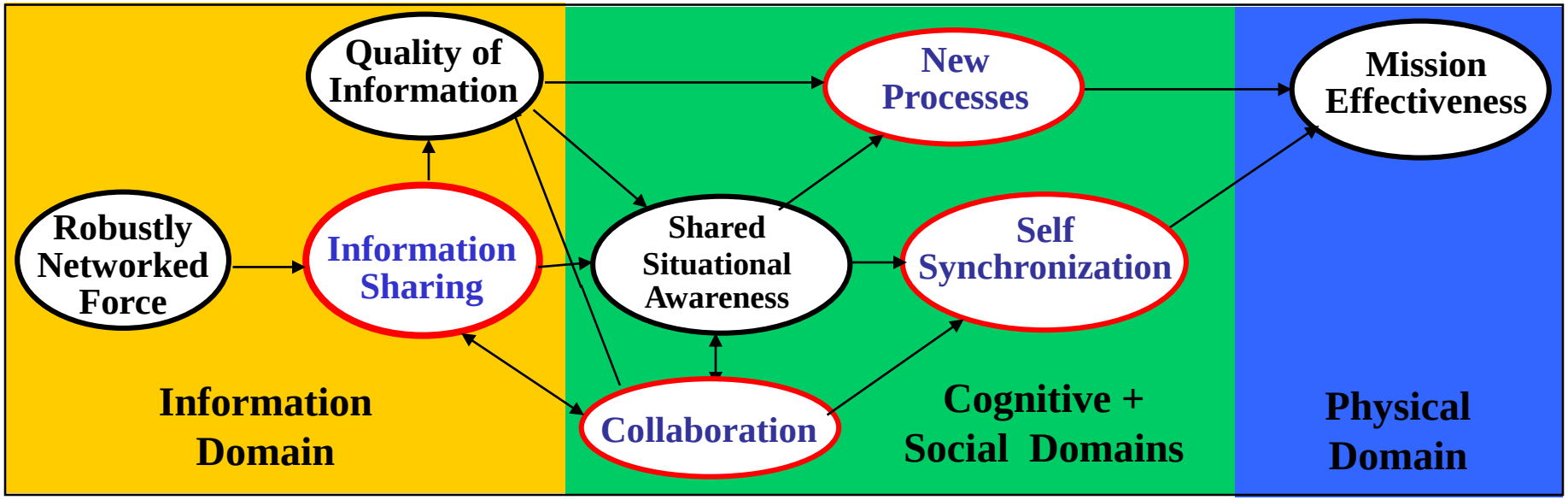
Warfighting Advantage - Exploit Behavioral Change & New Doctrine to Enable:

- Self-synchronization
- Speed of Command
- Increased Combat Power

Tenets of Network Centric Operations
…The New Value Chain

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- A Robustly Networked Force Improves Information Sharing
- Information Sharing and Collaboration Enhances the Quality of Information and Shared Situational Awareness
- Shared Situational Awareness Enables Collaboration and Self Synchronization and Enhances Sustainability and Speed of Command
- These in Turn Dramatically Increase Mission Effectiveness



Warfighting Advantage:
Evidence for Increased Mission Effectiveness

- **Maneuver – Networked Ground Forces**
  - **OIF: Networked Coalition Forces Demo Unprecedented Operational Agility / Speed of Maneuver (2003)**
  - **Networked Stryker Brigade Decisively Engages OPFOR at JRTC**
    -- 10 Fold Reduction in Loss / Exchange Ratio from 10/1 to 1/1 (2003-2004)

- **Offensive / Defensive Counter Air – Networked Air Forces**
  - **Data-Linked USAF F-15Cs Increased Kill Ratio by Over 250%**
    (JTIDS Operational Special Project - Mid 1990's)

- **Fires – Networked Air & Ground Forces**
  - **Networked Air / Ground Force Decisively Defeats NTC OPFOR**
    (USA Division Capstone Exercise - Phase I, Apr 2001)
  - **Networked Air / Ground Forces Decisively Prosecute Counter TBM**
    (Operation Iraqi Freedom – Western Iraq 2003)

NCO Case Studies

- **OFT Series of NCO Case Studies**
  - Focus on How Networked Forces Operate *and* Transform to Enable NCO
  - Conducted Across a Range of Mission Areas
  - Examine Exercises, Combat Ops & Peace Keeping Ops
  - Explore How US Forces, US Led Coalition Forces, NATO Forces, & US Allies Operate w/Varying Degrees of Networking Capabilities

- **Findings to Date Clearly Demonstrate…**
  - That Networked Forces Outperform Non-Networked Forces
    - 1.5 X to 10 X Improved Mission Effectiveness
  - Deployment of Less Than Perfect Networks Can Have a Significant Impact on Force Effectiveness by:
    - Significantly Improving Info Sharing
    - Dramatically Enhancing Situational Awareness for Commanders & Their Forces
  - Transformation Processes That Involve *Organizational & Process* Change Are Key to Achieving High Levels of Increased Mission Effectiveness

Breakout of NCO Case Studies

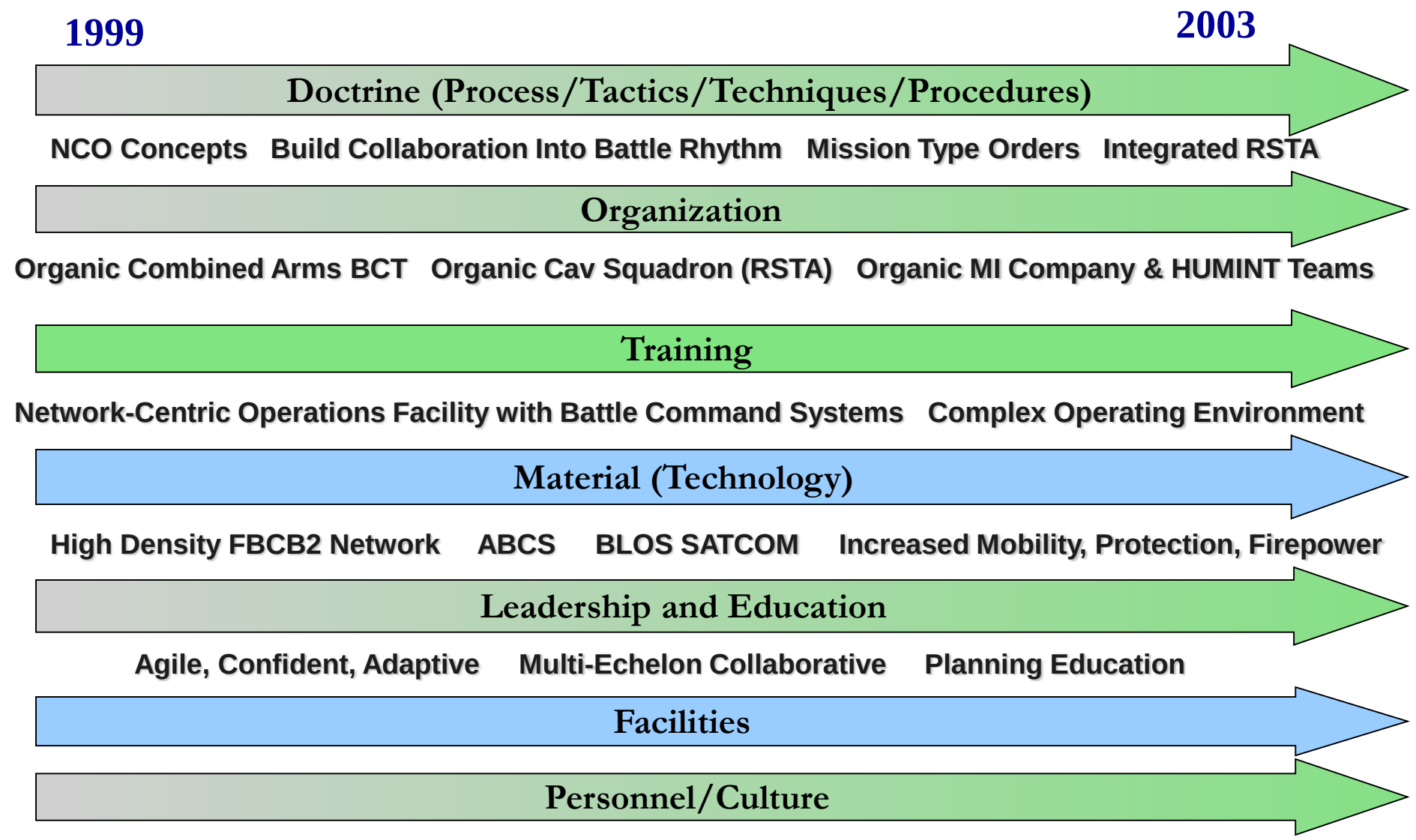
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	Service	Joint/Inter-Agency	Coalition
Sea	CTF-50 (OEF) NSWG I (OEF/OIF)		Coalition Maritime Ops (OIF)
Land	Stryker BCT (JRTC) V Corps/3 ID (OIF) Stryker BCT (SASO)		US/UK Coalition (OIF) NATO ACE Mobile Force Land NATO Task Force Fox
Air	Air-to-Air (JTIDS)	Air-to-Ground (OEF/OIF)	Air-to-Ground w/ SOF
Other		NCO in SASO UK Low Intensity Conflict SARS – Singapore	NATO Response Force Assessment

Completed
Near-Complete
On-Going
Planned

Stryker Brigade Combat Team:
Innovation Across all Lines of Development

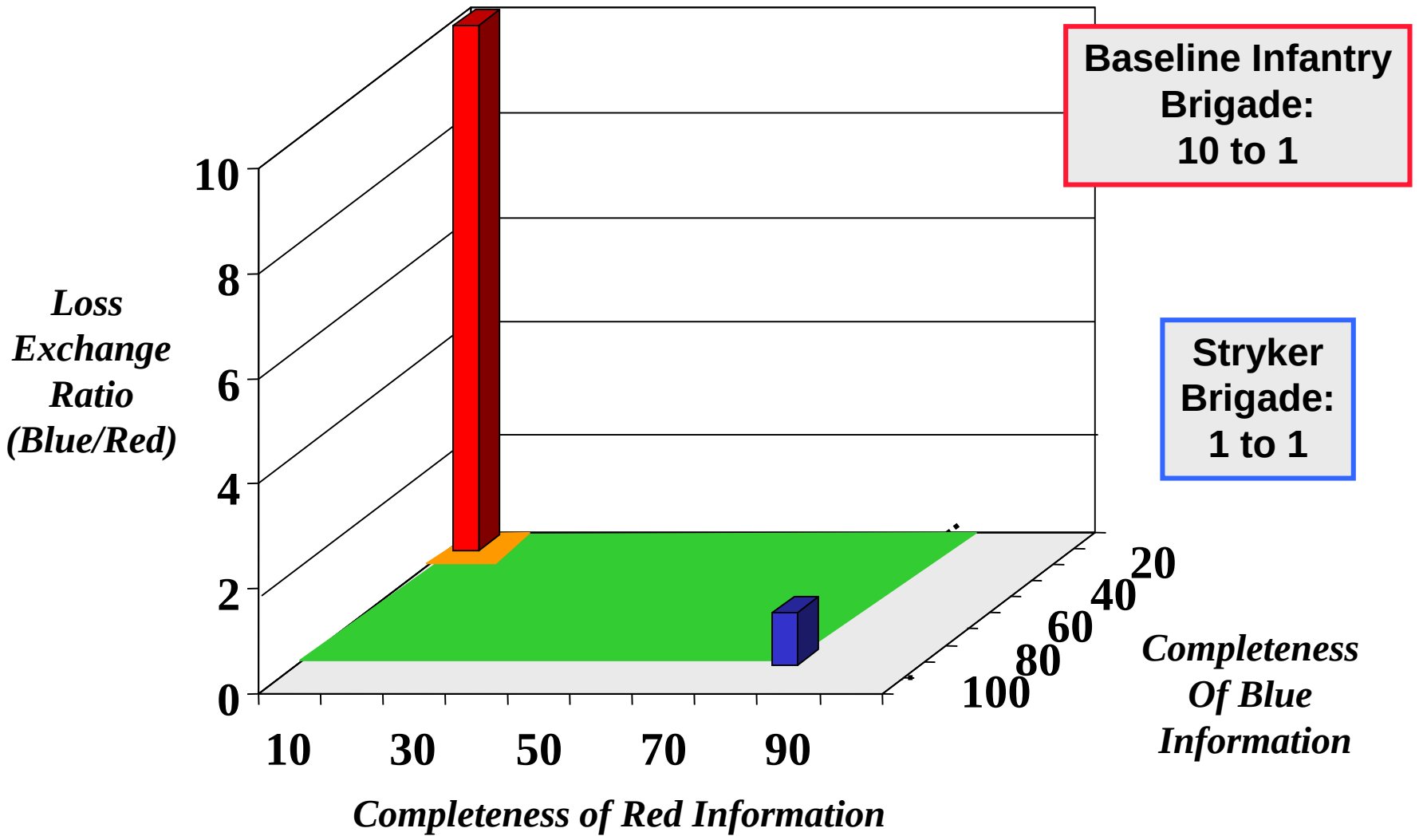
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Stryker Brigade:

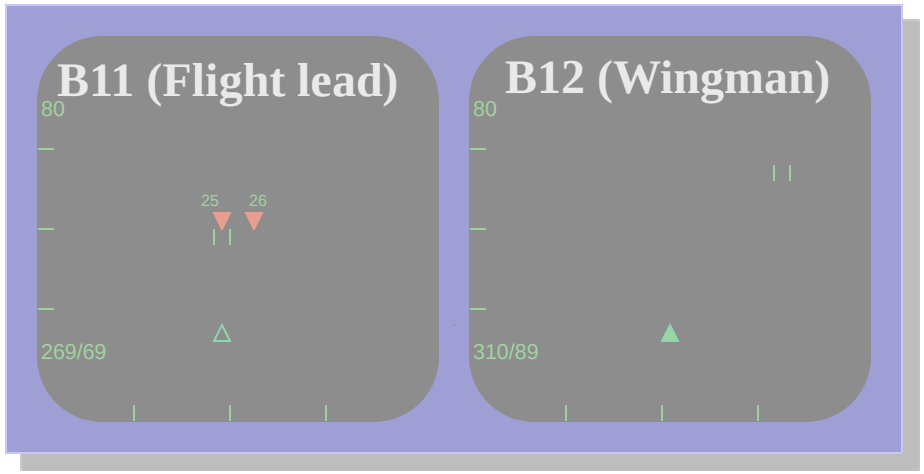
Mission Effectiveness as a Function of Information Position

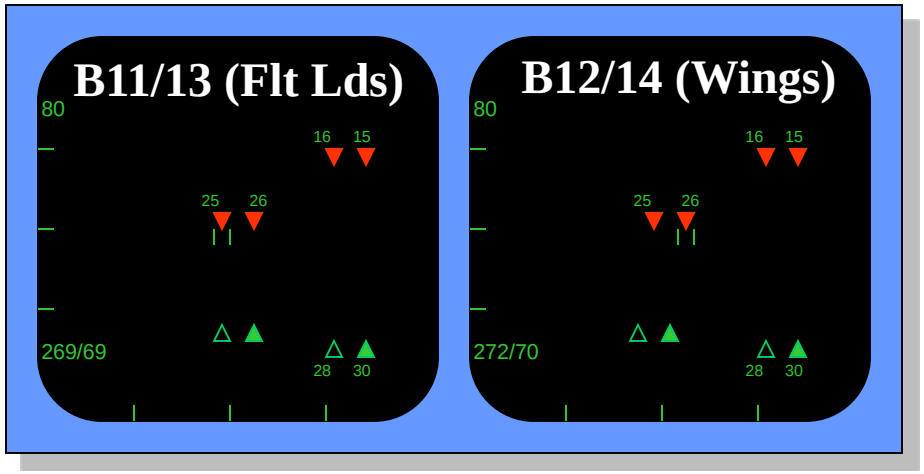
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Air to Air Case Study: Voice + Link 16 (JTIDS)

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B11 (Flight lead)

Voice Only	Information			Awareness	Understanding	Decisions
Voice + Link 16	Info	Awareness	Understanding	Decisions	"Combat Reserve"

B12 (Wingman)

Voice Only	Information			Awareness	
Voice + Link 16	Info	Awareness	Understanding	Decisions?	"Combat Reserve"

Time

A Common Picture…So What?

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- **Info Completeness: "Ownship" & Other Friendly Aircraft & Formations**
  - **Free Time = Ability to Focus on Fight**
- **Info Superiority: Quick Awareness & Understanding of Enemy Formations**
- **More Decision Time**
  - **More Lethal and/or Survivable Intercept Geometry Decisions**
- **Earlier/Better Targeting**
  - **Improved Shot Lethality**
  - **Higher Number Shots per Time**
- **Battle Manage & Target While Cold (with Same S.A.)**
- **Better Ability to Self-Synchronize ("Swarm")**

Kill Ratio Comparison

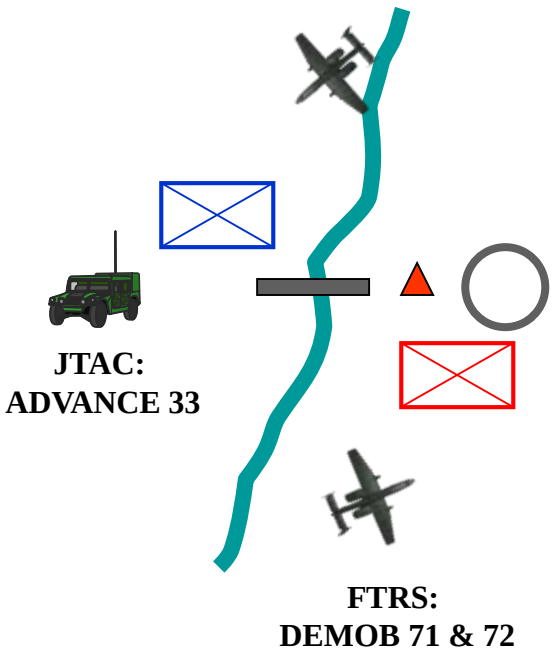
	Voice Only	Voice + Link 16
Day	3.10	8.11
Night	3.62	9.40

OIF CAS Example – Voice Only

Scenario: 6 Apr 2003, U.S. Troops Taking Fire from Iraqis on East Side of Bridge
JTAC Callsign: ADVANCE 33
A-10 Callsign: DEMOB 71 & 72
** Watching DEMOB 72 HUD Tape
WX: Poor Visibility & Clouds
Threats: AAA @ Target
Targets: Tanks, Vehicles, Personnel

1. **Target Location & ID:**
2. **Poor Quality of Info**
   Poor Info Share-ability
   Low Shared S.A.

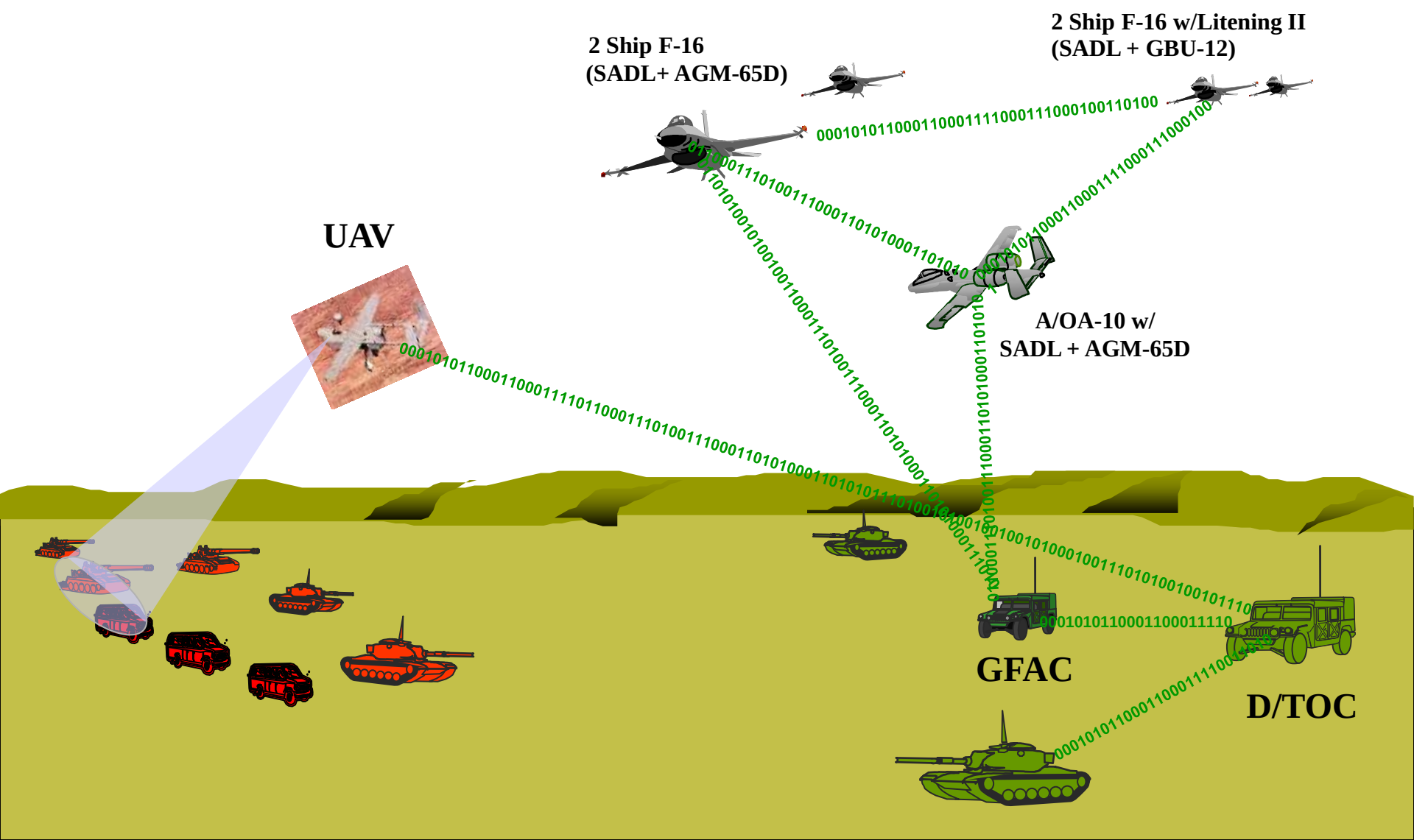
   Blue Air Positional SA:
   Low Shared S.A.
3. **Cognitive Loading:**
   Poor Info Sharing
   Poor Collaboration



DCXI: Nighttime CAS Scenario

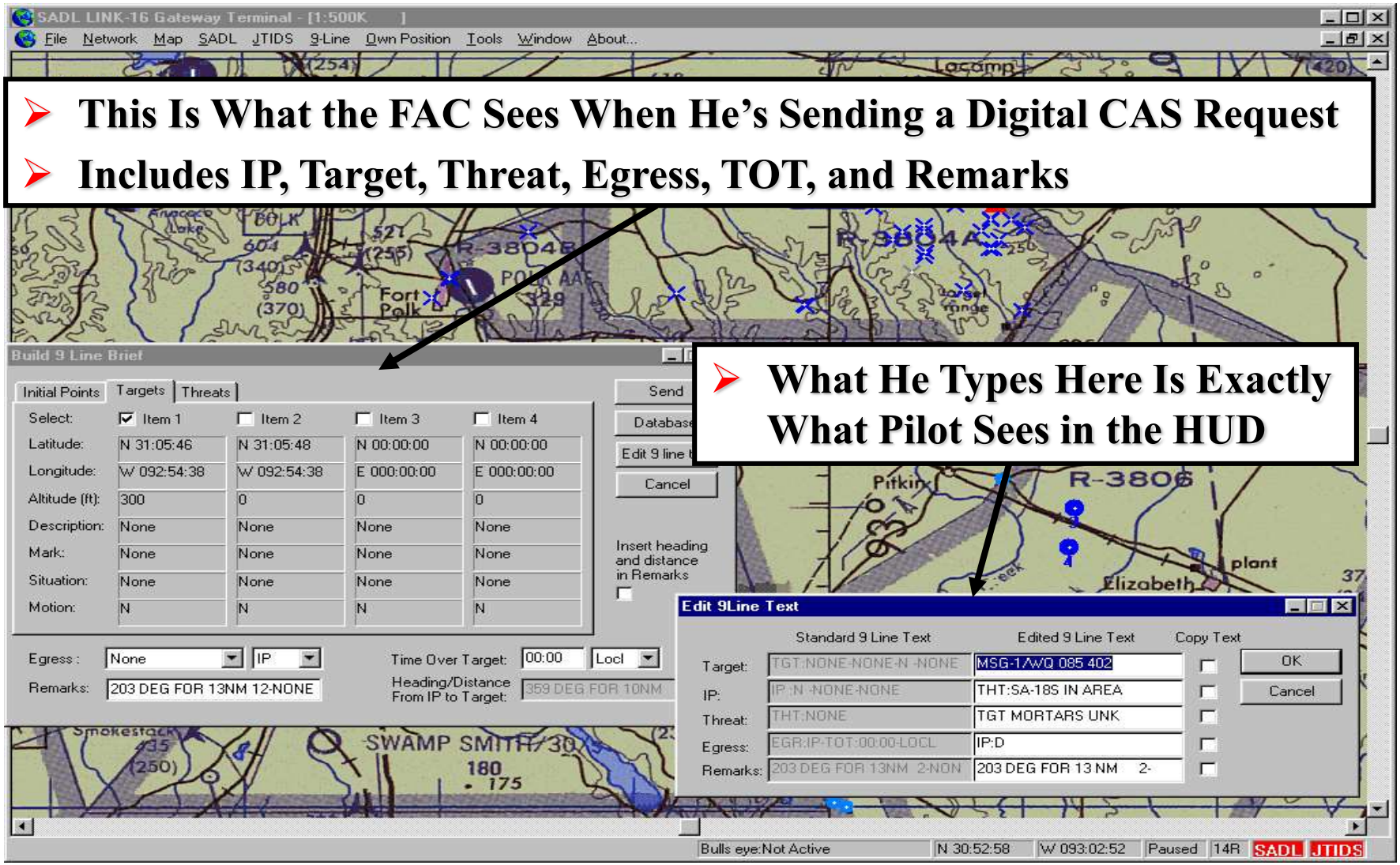
(Network Centric Warfare Systems vs. Legacy Systems)

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Air-to-Ground: FAC to Fighter Information Sharing

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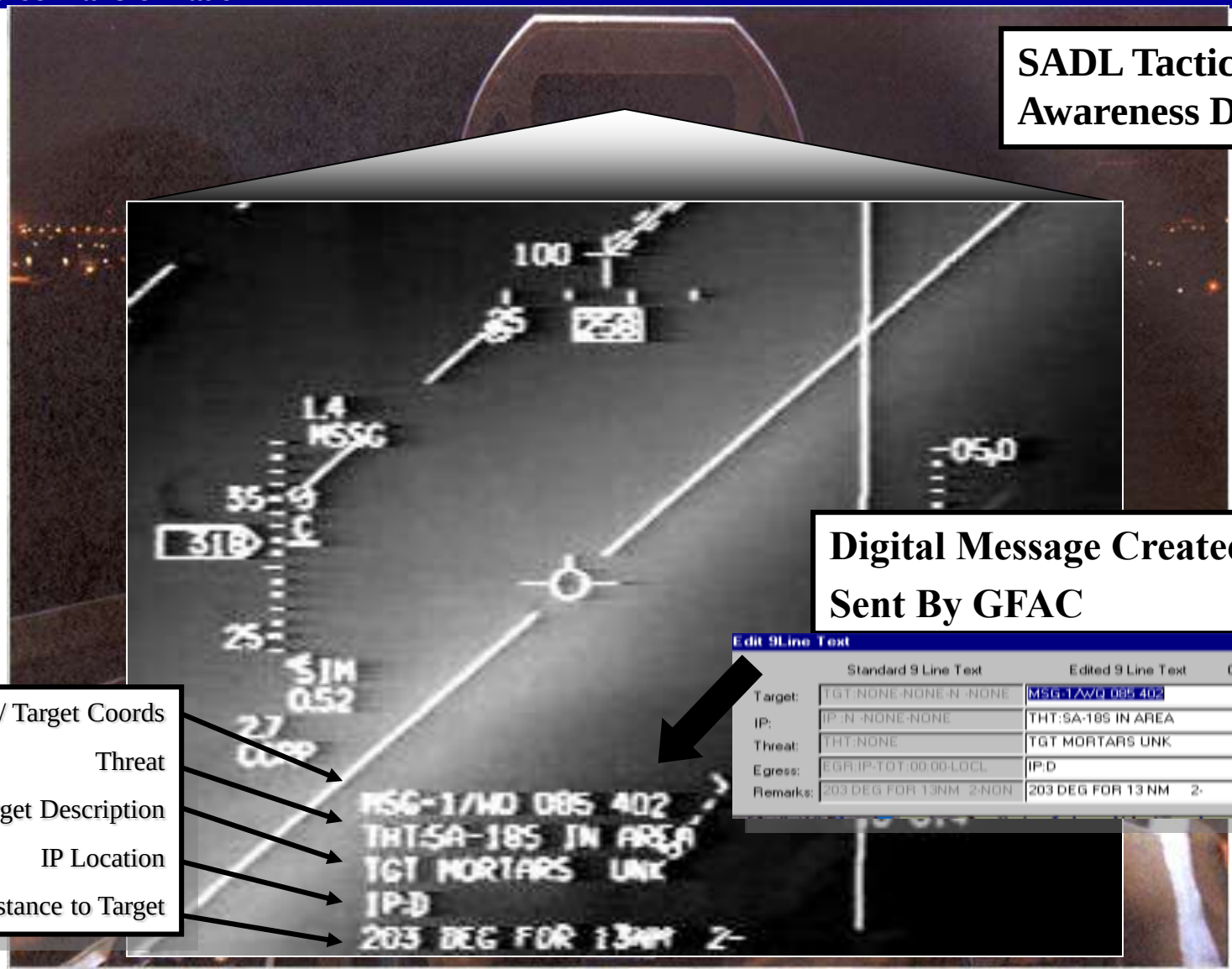


Air-to-Ground:
SADL F-16 Pilot Heads-Up Display

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SADL Tactical Awareness Displays

Digital Message Created & Sent By GFAC



MSG ID / Target Coords

Threat

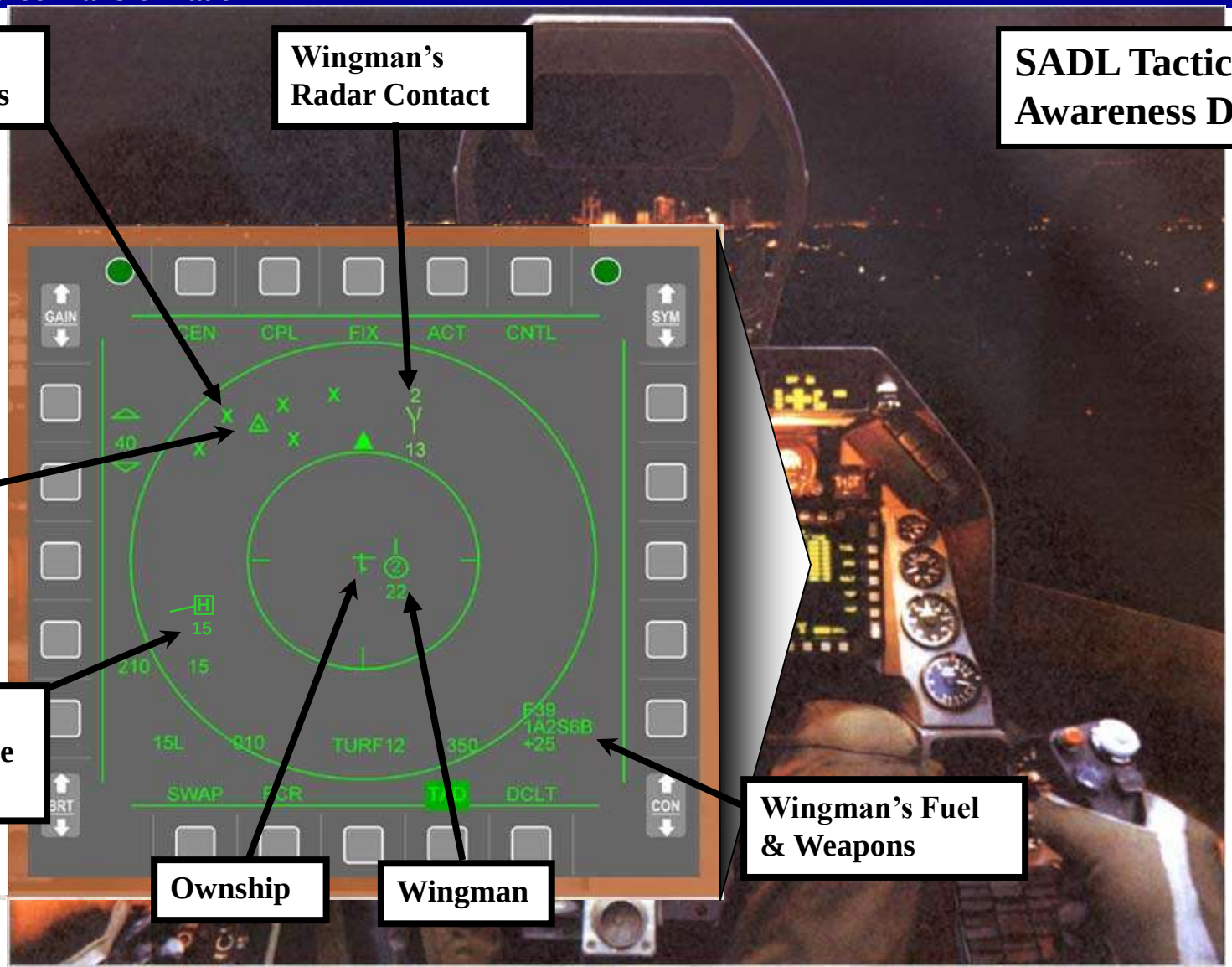
Target Description

IP Location

Heading/Distance to Target

Air-to-Ground:
SADL F-16 Pilot Tactical Picture

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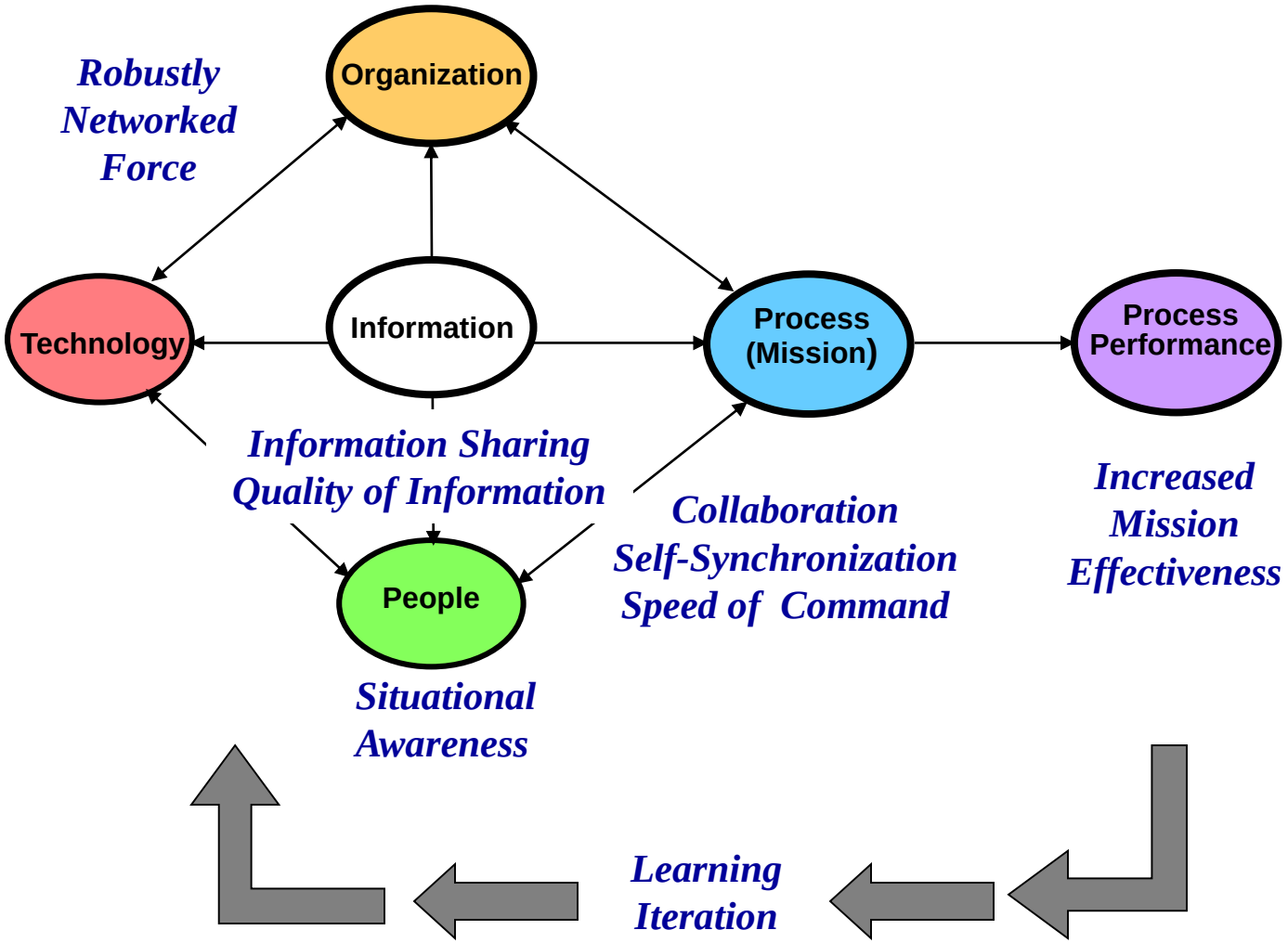
Transformation to Network Centric Operations: Insights and Challenges

- Transformation to NCO Involves ALL "Lines of Development"
  - **Technology**
    - Information Technology (IT) is Critical Enabler
    - Clear Benefit to Focused IT Investments
  - **Doctrinal (Process) and Organization**
    - Changes in These Areas are Key to Achieving Mature Capabilities for NCO
  - **Leadership**
    - Only Leaders Who Understand How Networked Forces Can Operate will Achieve Full Potential of NCO
    - Education & Training Key to Developing This Understanding

- Organizational Learning is Key Element of Implementation Strategy
  - Operational Experience can Accelerate Individual & Organizational Learning
  - NCO Short Course is an Experiment in Organizational Learning

Implementing Network Enabled Capabilities: Innovation Across all Lines of Development

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This Briefing is UNCLASSIFIED

Office of Force Transformation

Fighting the Networked Force: Insights from Network Centric Operations Case Studies

NDIA SE&T Conference

Charleston, SC

20 Apr 2005

Lt Col Jack "Ripper" Forsythe

OSD Office of Force Transformation

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Capability Based Approach to Joint Warfighting

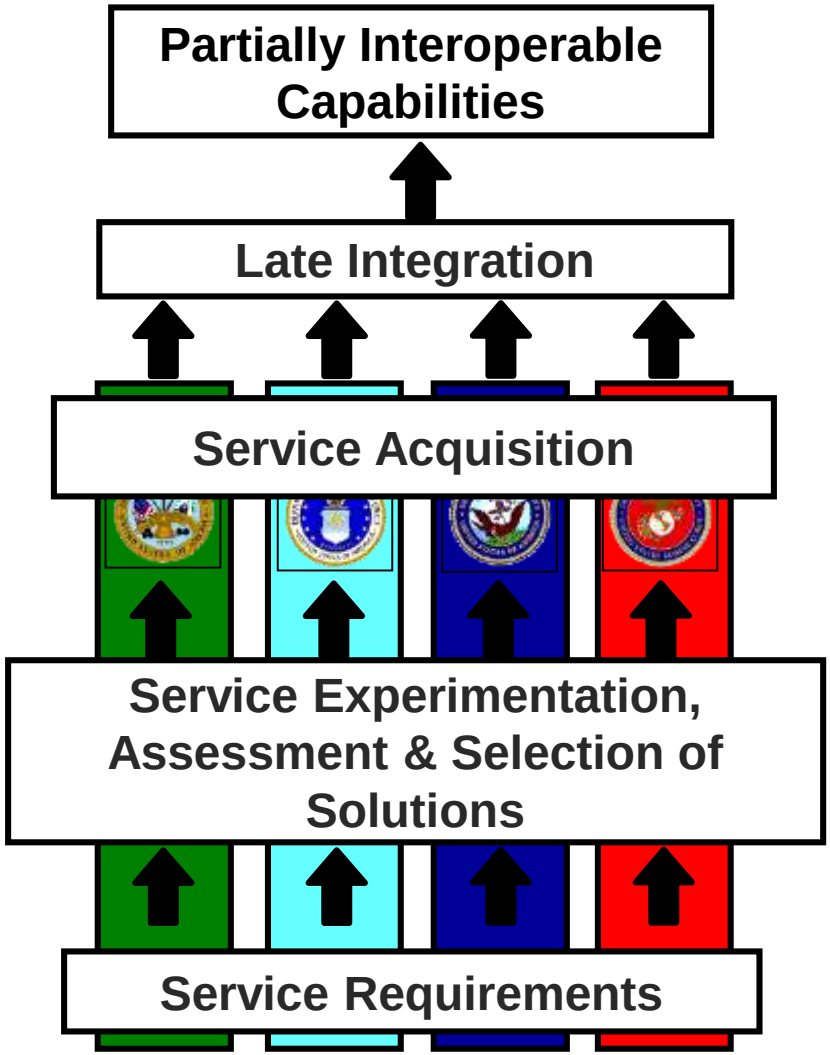
Presented by:
RDML Mark Harnitchek
Vice Director, Joint Staff Logistics Directorate
Tuesday, 19 April 2005

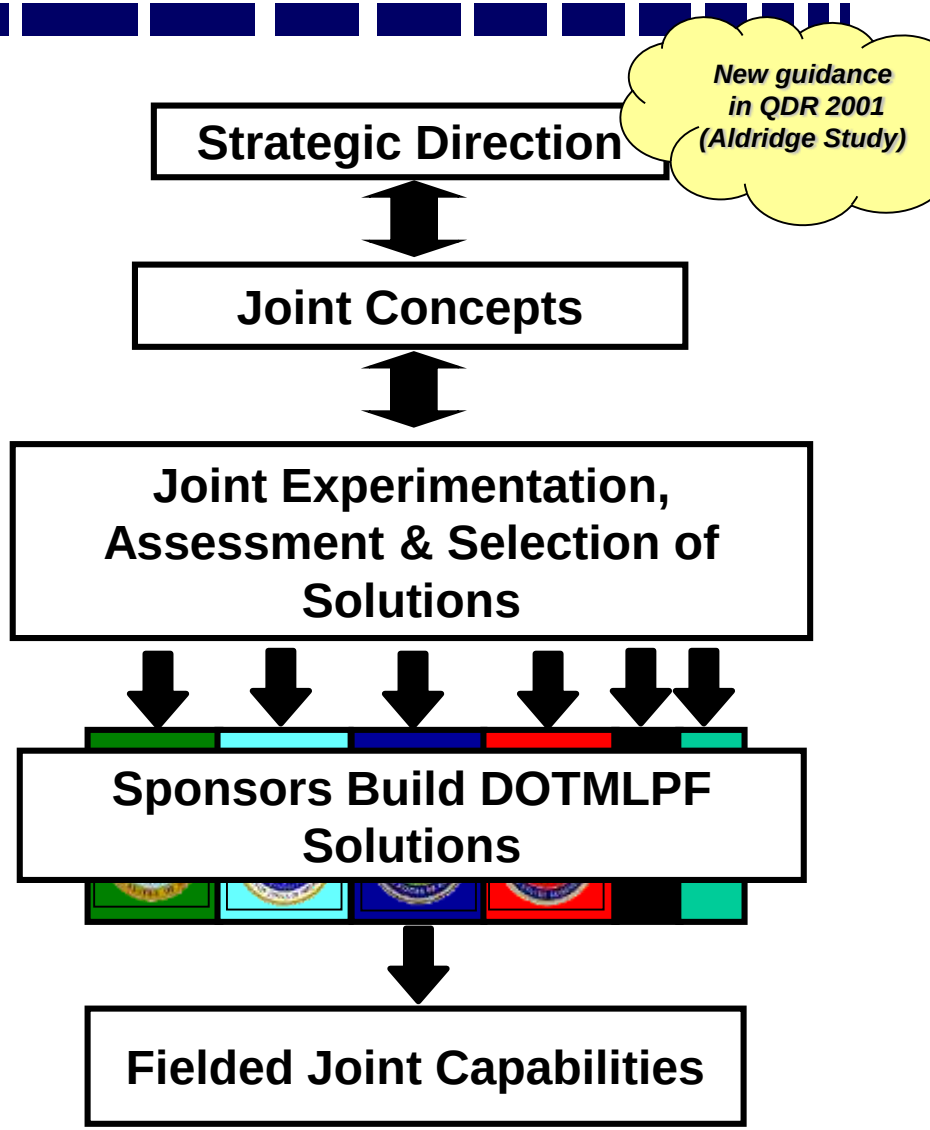
Charting the Course

- ***Joint Capabilities Integration & Development System***
- ***Focused Logistics***
- ***What This Means to Industry***

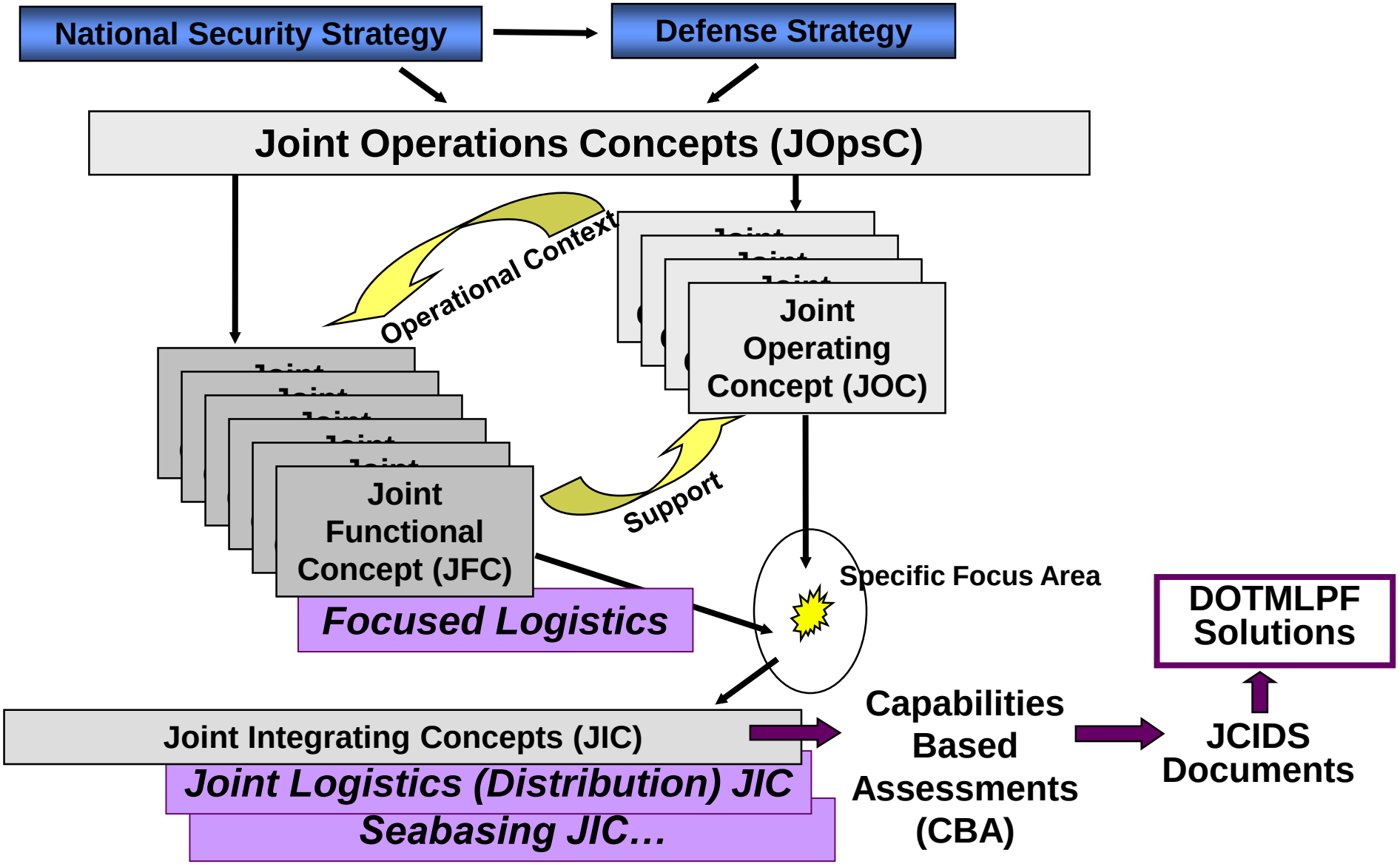


Capabilities Based Methodology





Joint Concepts to Capabilities



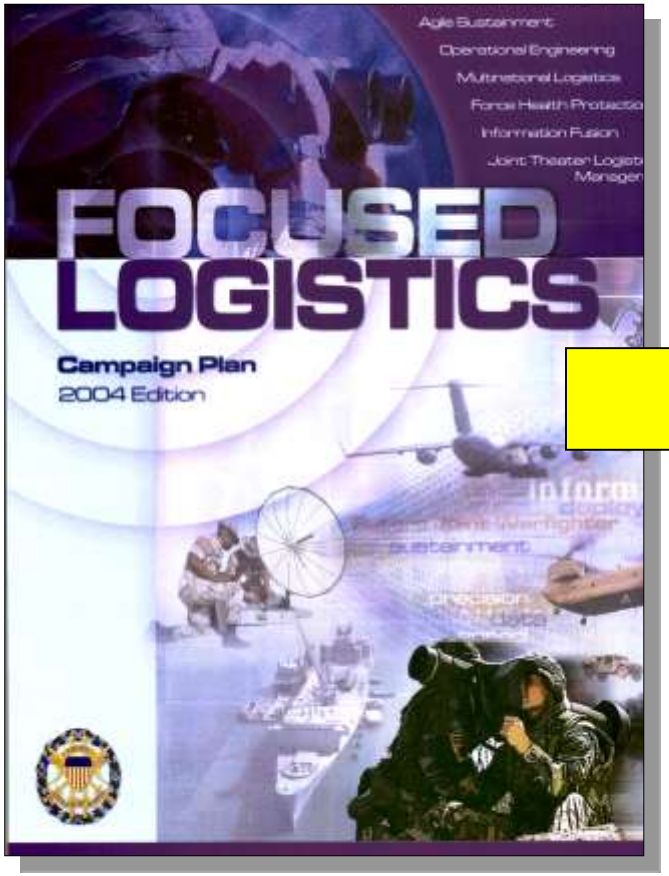
Impact to You … What's Different

- **New programs must fill a Joint capability/need**
- **Programs must be conceived joint**
- **All programs flow through 1 of 8 Functional Capability Boards**
- **Programs must have measurable attributes (KPPs) that support the joint warfighter**
- **JROC more focused on joint equity**
  - **previously cost focused**
  - **now capability focused … no dollar threshold**



Shaping the Future … a Capability-based approach

TIER 1



TIER 2

Capabilities

- Joint Deployment/Rapid Distribution
- Joint Theater Logistics Management
- Agile Sustainment
- Operational Engineering
- Information Fusion
- Multinational Logistics
- Force Health Protection

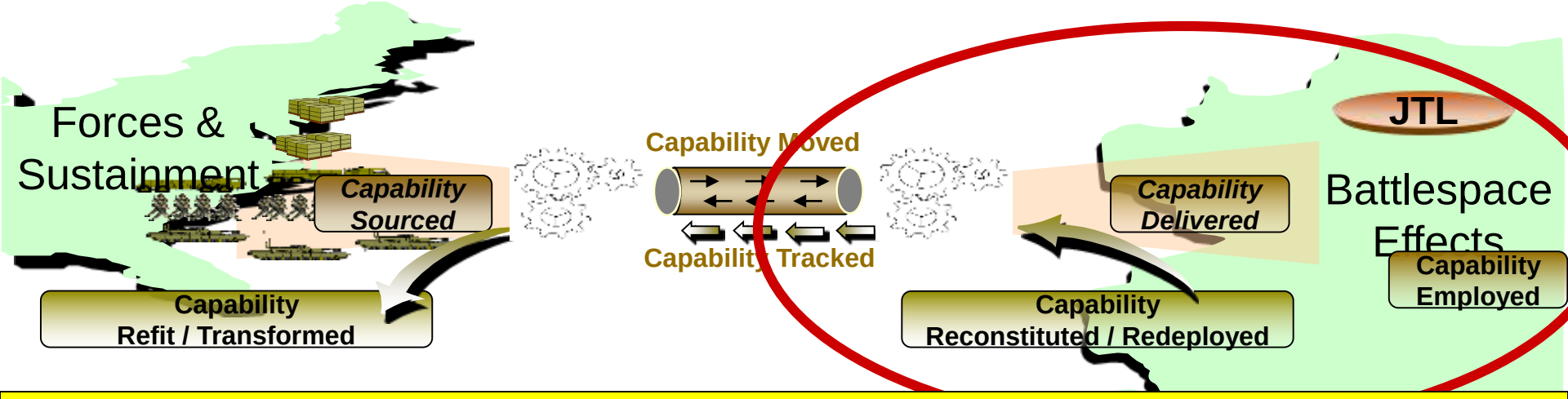
Fully Integrated - Expeditionary - Reliable - Networked
Effective - Affordable - Adaptable

Joint Theater Logistics (JTL)

Empowering the Joint Force Commander to
synchronize, prioritize, direct, integrate, and coordinate cross-service logistics functions

- **Issue – Best construct to exploit Joint & Service logistics capabilities for the warfighter**
  - ***What is best done by Service Components?***
  - ***- What is best done by Lead Service?***
  - ***What is best done jointly?***

- **Imperatives**
  - **Clear C^2 and responsibilities**
  - **Seamless Strategic, Operational, & Tactical linkages**
  - **Properly balanced to ensure optimum value added**



Not limited to ground operations

Joint Distribution / JTL

Defense Science Board
Task Force

on

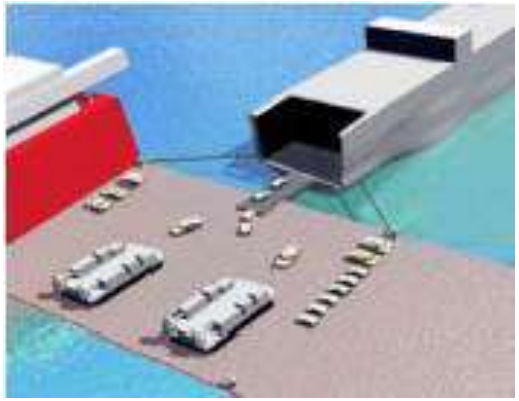
SEA BASING

August 2003

Office of Under Secretary of Defense
For Acquisition, Technology, and Logistics
Washington, D.C. 20301-3140

4 of DSB's
12 Enablers

Sustaining Troops Ashore



Inter-Theater Lift

Cargo Transfer

Logistics Support

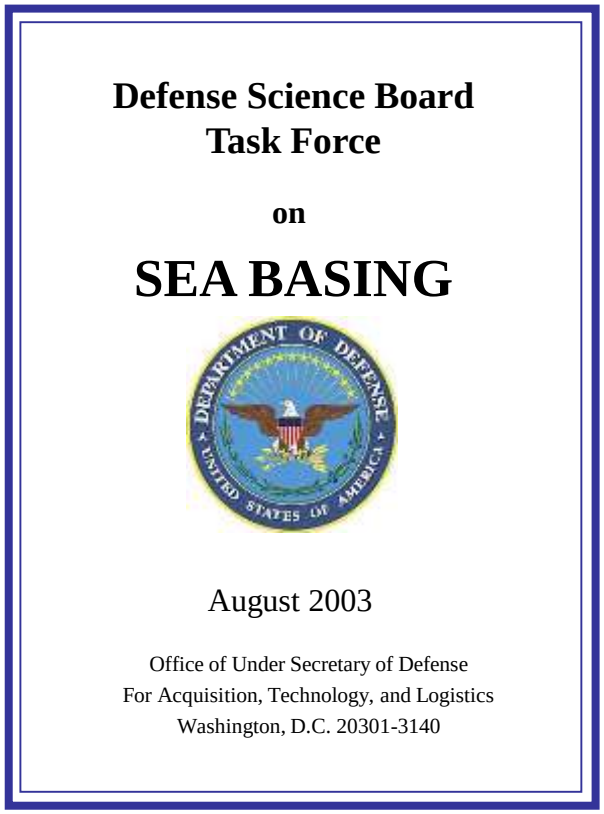
" … joint sea-basing … holds promise for the broader transformation of our overseas military posture"

National Defense Strategy

Our Challenge

SEA BASING's "DIRTY DOZEN"

1. A Joint Sea Base Program Office with meaningful Army and Air Force Participation
2. Sustaining Troops Ashore
3. Protecting the Force Ashore
4. Counter Threats in Littorals
5. Concept of Operations at Sea
6. Cargo Transfer at Sea
7. Long-range Heavy Lift Aircraft
8. Ships
9. Communication Architecture
10. Logistic Support
11. Inter-theater Lift
12. Development speed and funding



http://www.acq.osd.mil/dsb/reports/seabasing.pdf

Agile Sustainment

What We Need … Industry Solutions to Sustainment that are:

- ***Fully Integrated … all elements of logistics***
- ***Expeditionary … work anywhere***
- ***Reliable … consistent, no variation In support***
- ***Adaptable …versatile, agile, tailorable, and scalable***
- ***Affordable … within resource constraints***



Performance Based Support

- Performance Based Logistics (PBL): **A strategy for weapon system life cycle support that employs *purchase of performance as a package***
  - **delineates outcome performance goals**
  - **provides incentives for attaining goals**
  - **facilitates overall lifecycle management of system reliability, readiness, supportability and total ownership costs**







- **PBL…Key pillar of DoD's Future Logistics Enterprise**
  - **Goal…improve near-term readiness of critical platforms while** moving toward an end-to-end weapon system sustainment framework
  - **Directed in Strategic Planning Guidance…examine all major systems by 30Sep06!**

Examples

Performance Based Logistics Applied

Aircraft Tires

- Availability was 81% now 98%
- Delivery: 2 business days in CONUS, 4 days OCONUS
- No Government Inventory

Navy APU – Honeywell-NADEP Cherry Point Public/Private Partnership

- Units in Repair from 252 to 0
- From 60% to 98% shipped same day
- Customer Wait Time reduced from 35 to 5 days

USAF JSTARS

- Increased availability for training to 99% & flew 100% of scheduled missions over Afghanistan
- Provided 199 additional aircraft days in FY01 and FY02

U.S. Coast Guard PBL for 96 HH-65s Helos & 28 HU-25 Falcon Jets

- Readiness increased from 85% to 99+%
- Supply Chain reduced from 189 to 28 days

DoD & Industry Challenges

- **Compress the Supply Chain**
- **Reduce Cycle Time**
- **Adopt Industry Best Practices**
- **Embrace Performance Based Logistics**
- **Leverage Public-Private Partnerships**

Not business as usual …
open to new ideas …
take some risk

Partnership is pivotal. Success depends on synergy.

Defense Science and Technology
Crosscutting Challenges and Opportunities

- **Managing Risk and Cost**
  - Trusted Microcircuits
  - Anti-tamper
  - Software assurance
  - Software protection
- **Software Producibility**
- **Modeling and Simulation**

Dr. Charles J. Holland
Deputy Under Secretary of Defense
(Science & Technology)

Navy S&T Focus

National Defense Industrial Association
Charleston SC
Apr 19-21 2005

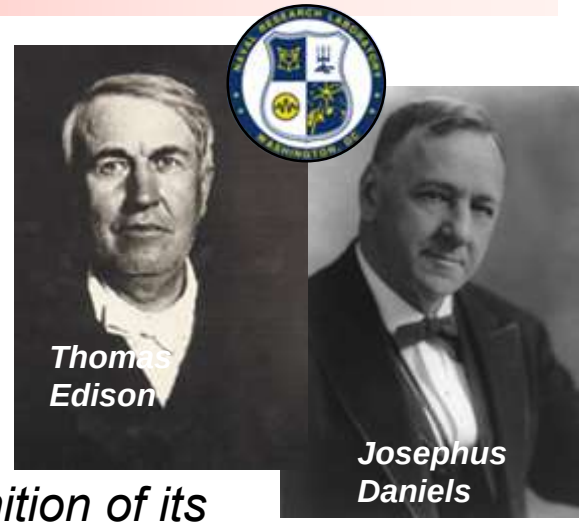
CAPT J.C. Kamp
Assistant Chief of Naval Research

Objectives

- Provide overview of ONR
- Discuss some Naval S&T foci
- Note some opportunities

Naval Research: An Enduring and Evolving Mission

Naval Research Laboratory ***(Appropriations Act, 1916)*****:**
"[Conduct] exploratory and research work … necessary… for the benefit of Government service, including the construction, equipment, and operation of a laboratory…."

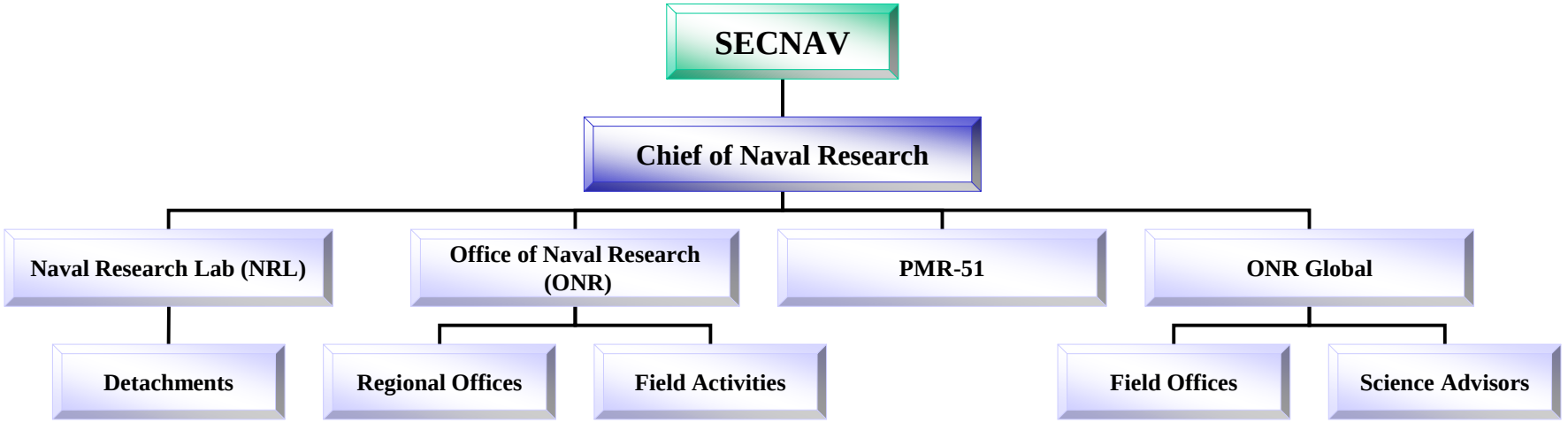


Office of Naval Research ***(Public Law 588, 1946)*****:**
"… plan, foster, and encourage scientific research in recognition of its paramount importance as related to the maintenance of future naval power, and the preservation of national security.… "



Transitioning S&T ***(Defense Authorization Act, 2001)*****:**
"…manage the Navy's basic, applied, and advanced research to foster transition from S&T to higher levels of research, development, test, and evaluation."

ONR Organization



Naval S&T in Context: FY 2006 President's Budget

Secretary of the Navy — $126B

Assistant Secretary of the Navy
Research, Development and Acquisition

Research and Development — 18.0B

Acquisition — 31.3B

VCNO & ACMC — 1.8B

Office of Naval Research

Naval Research Lab

16.2B

PEOs, Systems Commands, Warfare Centers

Basic Research

Applied Research

Advanced Tech. Development

Test & Evaluation

DEM/Val

EMD

Op. Systems Development

12 Program Executive Officers

5 Direct Reporting Program managers

6 Systems Commands

Warfare Centers

54 Major Program managers

467 Program managers

Aircraft carriers

Combat ships

Submarines

Aircraft

Weapons systems

Ammunition

Combat boots

Source: FY06 Blue Book, FY06 R-1

Objectives

- Provide overview of ONR
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- Note some opportunities

S&T Support to USMC in Iraq

- Challenges:
  - Improvised Explosive Devices (IEDs)
  - Persistent surveillance
  - Weapons location
  - Helicopter operations
  - Language support



OIF/OEF Medical Initiatives



Naval Combat Trauma Registry (CTR)



USB Memory Devices For Medical Records



"Ready-Heat" Thermal Blanket



Tactical Field Care -
Tactical Combat Casualty Care (TC3) Training CD

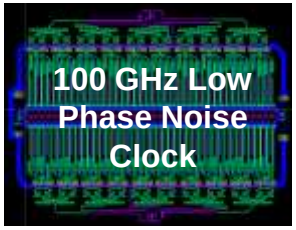
Information, Electronics and Surveillance (Code 31)

- Surveillance capabilities, communications, command and control
- New concepts for electronic devices
- Application of information sciences to complex problems including human-computer interaction
- Electronic warfare

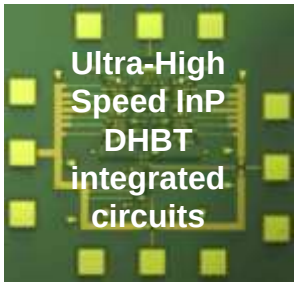


Advanced Multi-Function RF











technologies to meet future radar requirements

Ocean, Atmosphere, and Space (**Code 32)**

- Battlespace Environments - (BSE)
- Anti-Submarine Warfare - (ASW)
- Mine Warfare - (MIW)
- Naval Special Warfare/Explosive Ordnance Disposal
- Advanced Force Operations



Autonomous Vehicles





Letting robots do the dangerous work





Engineering, Materials, and Physical Sciences (**Code 33)**

- Chemistry
- Physics
- Structural & functional materials
- Structural, solid, & fluid mechanics
- Propulsion
- Energetics
- And hull, mechanical,
- & electrical systems



Explosive Resistant Coating









Human Systems (**Code 34)**

- Exploration programs at the leading edge of medical science
- Human performance
- Biotechnology
- Training and human factors
- Neural information processing
- Biorobotics



Virtual At Sea Training (VAST)





Realistic fire support training for the Navy-Marine Corps Team

Naval Expeditionary Warfare **(Code 35)**

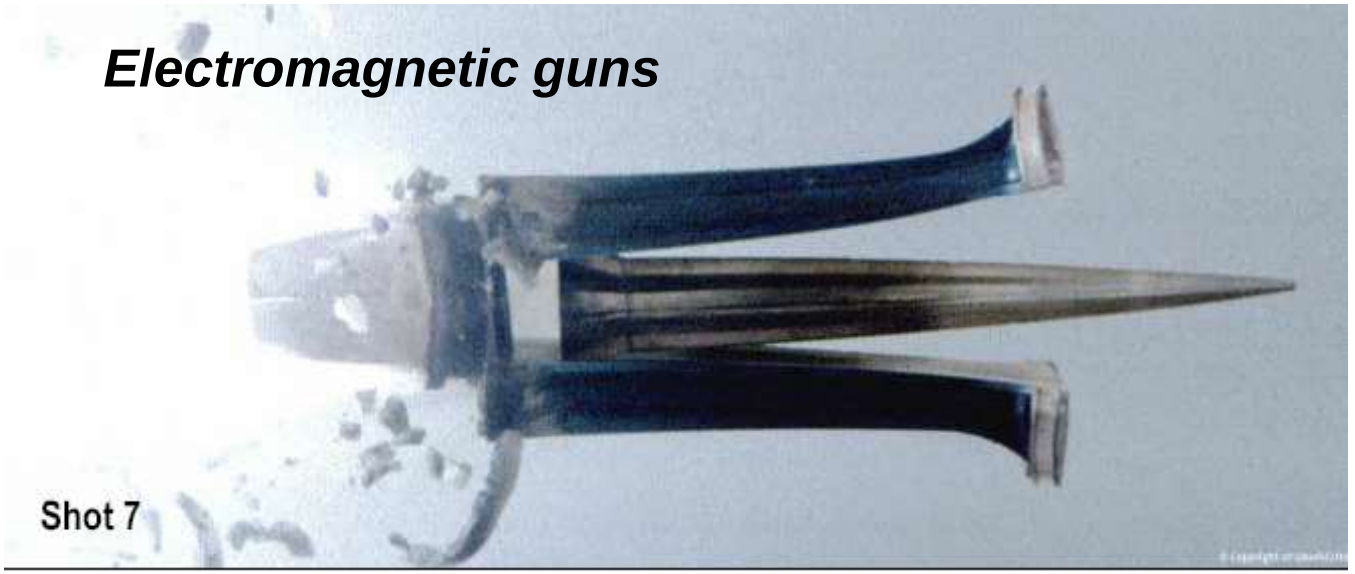
- Aeronautics, avionics
- Propulsion, ballistics, warheads
- Missile guidance, seekers
- Parallel distributed processing
- Technology programs particularly associated with Marine Corps/ground combat applications



Hypersonic Strike

Speed kills

Electromagnetic guns





Industrial and Corporate Programs (**Code 36)**

- Interdisciplinary S&T
- Workforce renewal
- Industrial/academic outreach



ONR Global

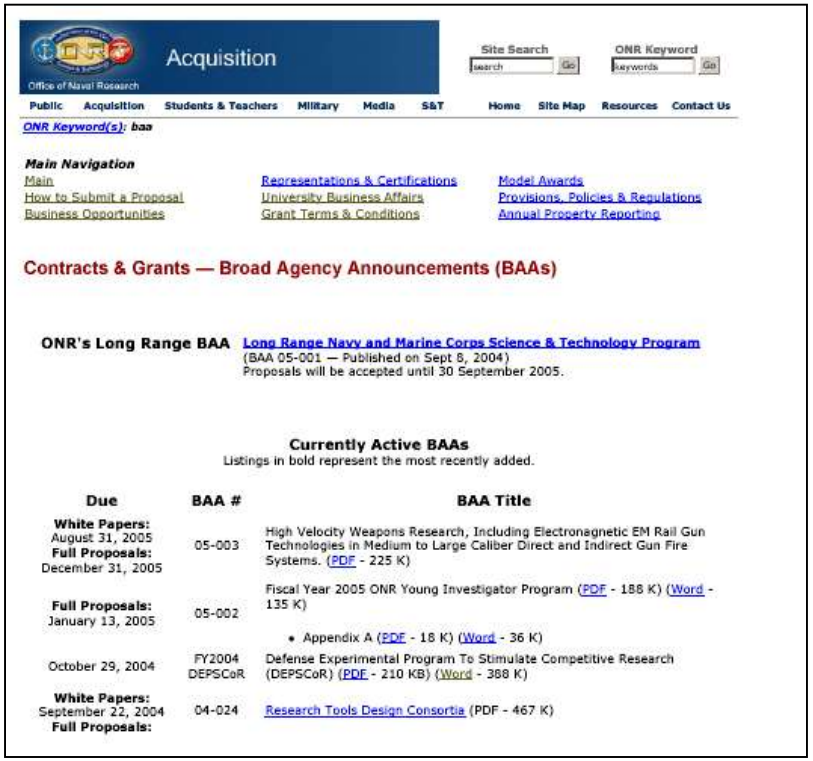
- Ocean Atmosphere Space Sciences
- Naval Architecture HM&E
- Materials Science
- Sensors and Information Technology
- Force Protection/Anti Terrorism
- Biosciences
- Human Factors

Objectives

- Provide overview of ONR
- Discuss some Naval S&T foci
- Note some opportunities

ONR Broad Agency Announcements

- Where:
  - FEDBIZOPPS www.fedbizopps.gov
  - ONR Webpage www.onr.navy.mil/02/baa/
- Types:
  - Continuous/Open (1)
  - Specific Subject/Due Date (4)
  - Mix of Both



Acquisition

Office of Naval Research

Site Search | ONR Keyword

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ONR Keyword(s): baa

Main Navigation

Main | How to Submit a Proposal | Business Opportunities | Representations & Certifications | University Business Affairs | Grant Terms & Conditions | Model Awards | Provisions, Policies & Regulations | Annual Property Reporting

Contracts & Grants — Broad Agency Announcements (BAAs)

ONR's Long Range BAA Long Range Navy and Marine Corps Science & Technology Program
(BAA 05-001 — Published on Sept 8, 2004)
Proposals will be accepted until 30 September 2005.

Currently Active BAAs
Listings in bold represent the most recently added.

Due	BAA #	BAA Title
White Papers: August 31, 2005 **Full Proposals:** December 31, 2005	05-003	High Velocity Weapons Research, Including Electromagnetic EM Rail Gun Technologies in Medium to Large Caliber Direct and Indirect Gun Fire Systems. (PDF - 225 K)
Full Proposals: January 13, 2005	05-002	Fiscal Year 2005 ONR Young Investigator Program (PDF - 188 K) (Word - 135 K) • Appendix A (PDF - 18 K) (Word - 36 K)
October 29, 2004	FY2004 DEPSCoR	Defense Experimental Program To Stimulate Competitive Research (DEPSCoR) (PDF - 210 KB) (Word - 388 K)
White Papers: September 22, 2004 **Full Proposals:**	04-024	Research Tools Design Consortia (PDF - 467 K)

http://www.onr.navy.mil/02/baa/

Navy-Industry R&D Partnership Conference



26-29 July 2005, Washington, DC

2005 SBIRs



2-4 May 2005, Reston, VA

- www.dawnbreaker.com/forums/navy
- SBIR Solicitation 2005.2
  - release 2 May 2005;15 Jun- 15 July 2005
- SBIR Solicitation 2005.3
  - release 1 Aug 2005; 15 Sep - 14 Oct 2005

NRL Tech Transfer



http://techtransfer.nrl.navy.mil/index.php

Navy TECHMATCH



http://www.navytechmatch.com/DOD/index.aspx

Other Collaboration Opportunities

- ONRG Adjunct S&E program
  - military (active/reserve)
  - gov't employee
  - IPA
  - gov't contractor
  - grantee



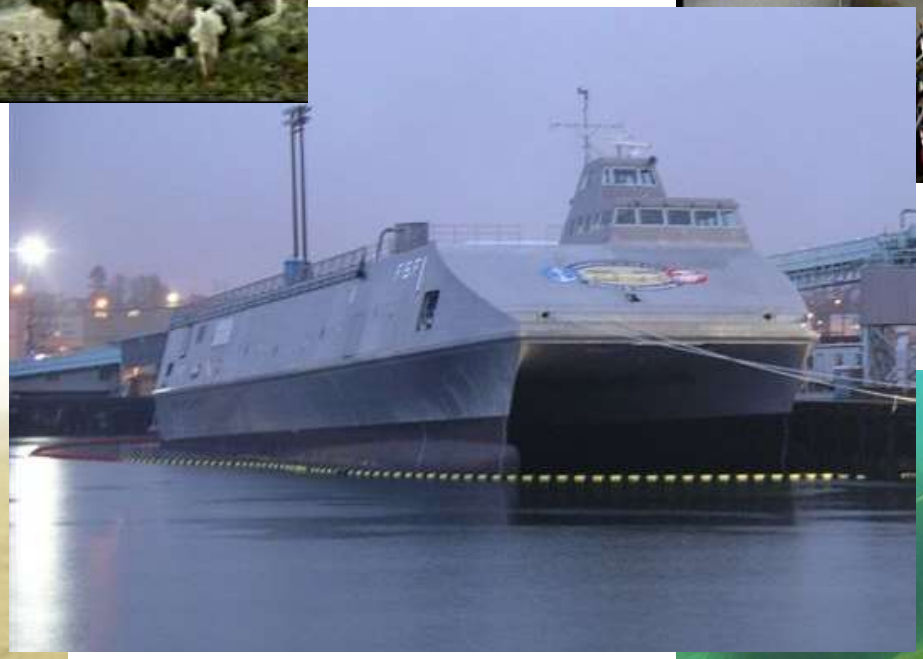
http://www.onrglobal.navy.mil/about/collaboration.asp

Naval Research delivers…

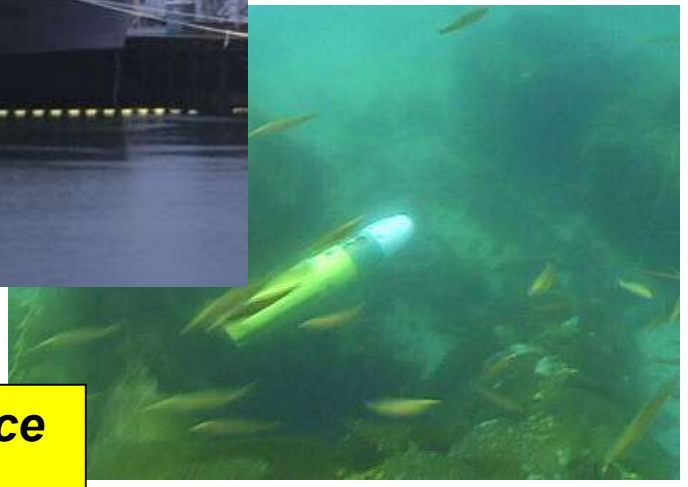










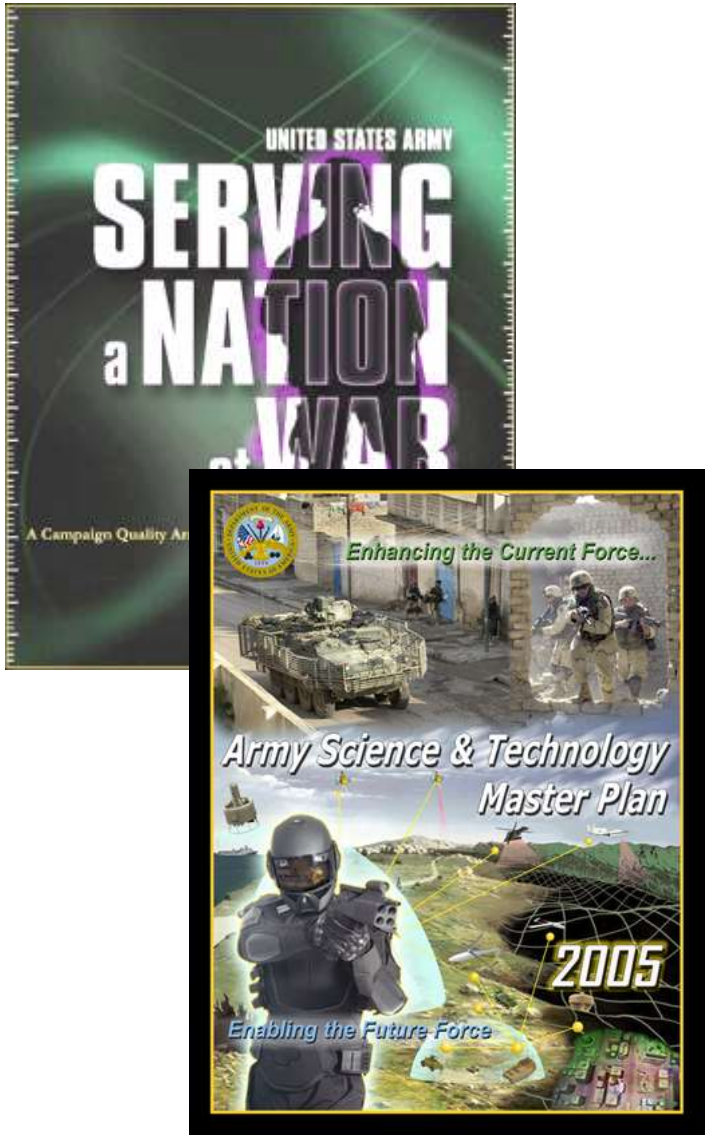


"… scientific research… related to the maintenance of future naval power, and the preservation of national security…. "

Focus of the Army Science & Technology Program

DoD Technology Exposition

21 April 2005



Dr. Thomas Killion
Deputy Assistant Secretary for Research and Technology/ Chief Scientist

Purpose

Describe the focus of the Army's S&T program

- ***Enabling the Future Force—Future Combat Systems***
- ***Enhancing the Current Force—Force Protection and networks***

Army S&T Vision—
Pursuing Transformational Capabilities

Speed, Reach, and Precision

Current Force



~100 lb. load



70+ tons





< 10 mph

From Platforms to System of Systems

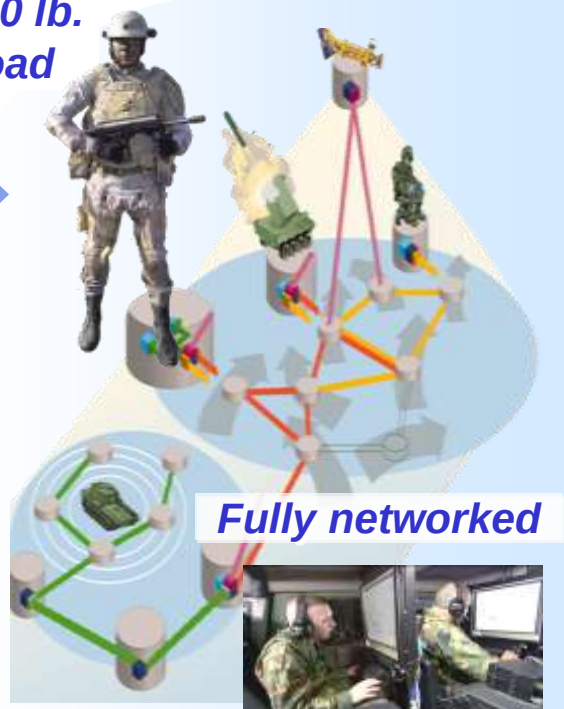
Enabling the Future Force



Enhancing the Current Force

Future Force

< 40 lb. load



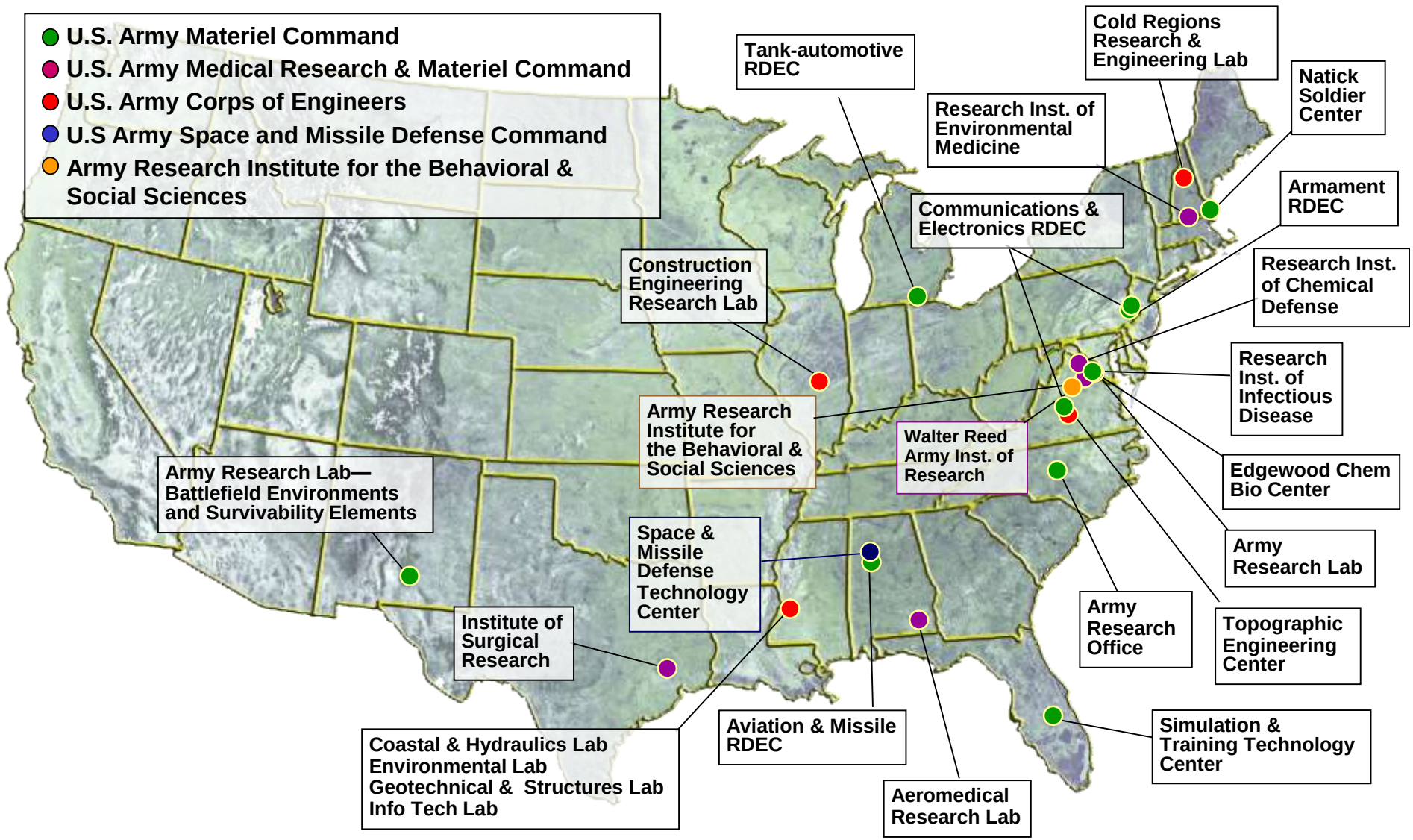
Fully networked

< 20 tons



> 40 mph

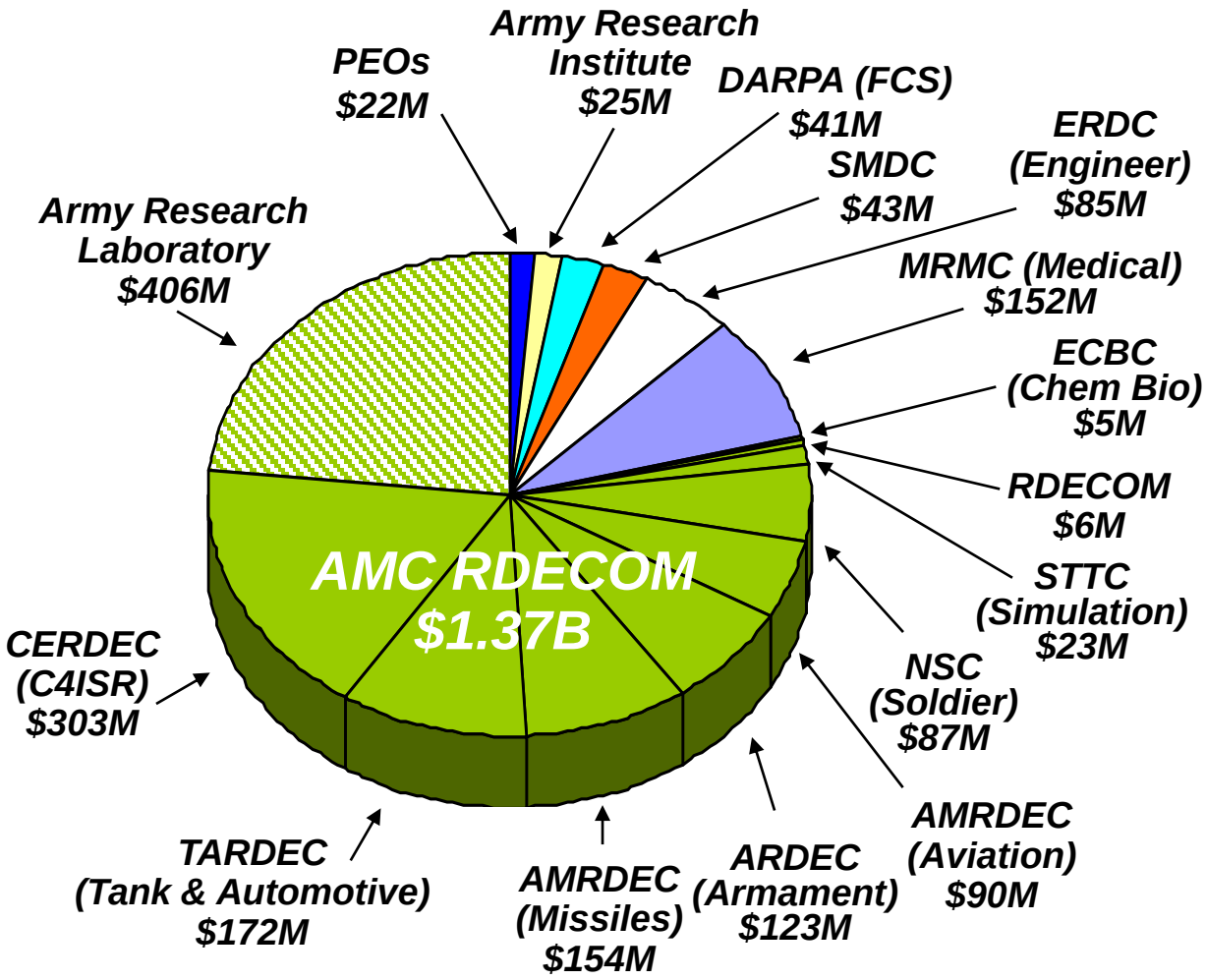
Army Research, Development & Engineering Centers and Laboratories



FY06 Army S&T Investment Perspective

President's Budget

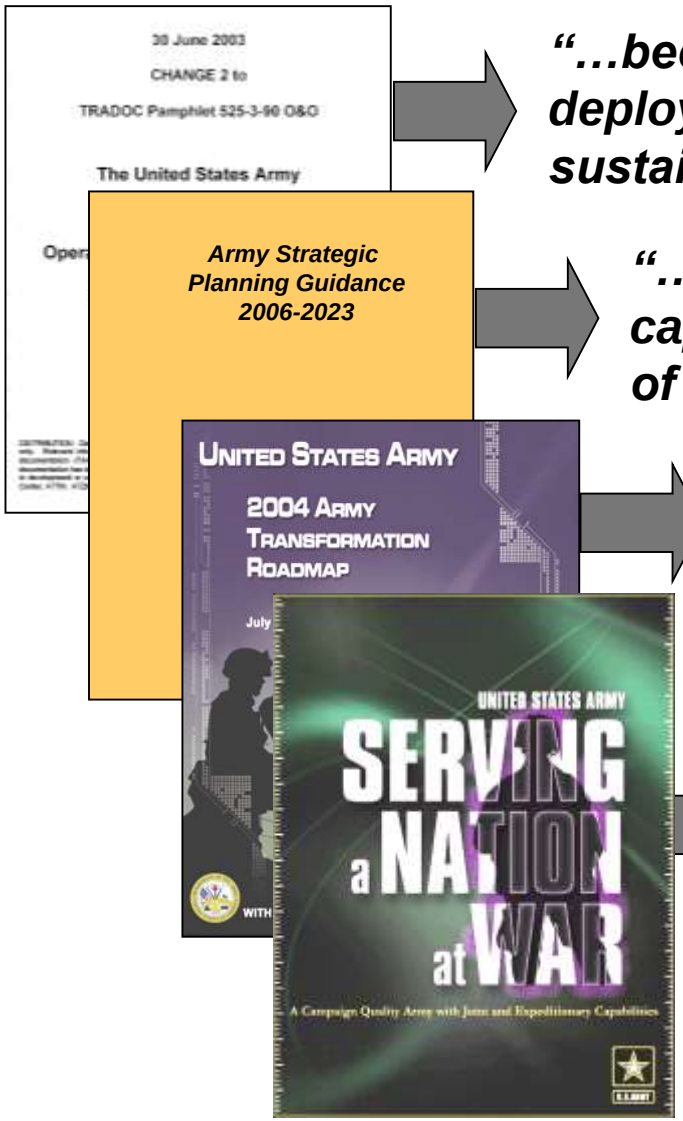
Lab	FY06
Army Research Lab	$406M
CERDEC (C4ISR)	$303M
TARDEC (Tank & Automotive)	$172M
AMRDEC (Missiles)	$154M
MRMC (Medical)	$152M
ARDEC (Armament)	$123M
AMRDEC (Aviation)	$90M
NSC	$87M
ERDC	$85M
SMDC	$43M
DARPA (FCS)	$41M
Army Research Institute	$25M
STTC	$23M
PEOs	$22M
RDECOM	$6M
ECBC	$5M
FY06 S&T Total	**$1.74B**



FY06 Budget Highlights

- ***$308M for basic research to enable paradigm-shifting capabilities to ensure future land component dominance in Joint Force Operations. Key investment areas include nanoscience, biotechnology and immersive simulations.***
- ***$292M for C4ISR technologies that enable networked surveillance and knowledge systems for decisive command on-the-move operations.***
- ***$258M for lightweight precision munition technologies that enable networked lethality to provide high volume, accurate strikes to deny enemy sanctuaries, including directed energy applications.***
- ***$173M force protection technology. Includes funding for counter IED technology and active/passive protection for both ground and air vehicles.***
- ***$87M for high efficiency, lightweight Energy and Power sources for Soldier System and land combat vehicle applications.***
- ***$86M for technologies to enable semi-autonomous and autonomous unmanned ground and air systems integrated into the land component formation.***

Responding to Army Needs



"…become a more strategically responsive, deployable, agile, versatile, lethal, survivable, and sustainable force, effective in all situations …"

"…provide relevant and ready land power capability to the Combatant Commander as part of the Joint Team"

"…provide dominant land power to the Joint Force now and into the future."

"…change in time of war must deal simultaneously with both current and future needs"

Army S&T Program Drivers—
Current and Future Force Capability Gaps

Emerging Top Challenges for Current Force

- Improve Soldier Protection in Counter-Insurgency Environment
- Provide Prototype Network Enabled Battle Command to Current Force
- Provide Responsive, Networked, Precision Fire
- Protect the Force in Non-Contiguous Battlespa
- Improve Non-Lethal Capabilities for the Curren
- Improve Ability of Current Forces to Conduct J
- Expand HUMINT Capabilities
- Increase Ability and Speed of Analysis and Inf
- Increase Army Ability for Sustained, High Oper
- Improve SOF and Conventional Forces Integra

Top Ten Future Required Capabilities from Capabilities Needs Assessment

- Enhance Soldier Protection
- Provide Effective C^2 Throughout All Phases of Ops; Any Location
- Enhance Platform Protection
- Provide C^4 Architecture – Fully Functional in all Conditions, LOS/NLOS
- Provide Modular, Tailorable Forces Rapidly Deployable in Mission Config
- Lethality Overmatch – Any Enemy LOS/BLOS/NLOS, All Conditions
- Allow Train as you Fight, Operating Similar at both CTCs & Home Station
- Provide Superior ISR – Modular, Scalable, Tailored Battlefield Awareness
- Provide Enhanced Countermine (CM) Capabilities
- Provide Modular Forces Tailored for Self-Sufficiency and Endurance

15

Enhancing the Current Force supporting GWOT

Soldier Protection



Interceptor Body Armor is a modular, multi-threat Body Armor using an Outer Tactical Vest (OTV) and Small Arms Protective Insert (SAPI) Plates

- *Key Technologies: Advanced high performance*

7.62 mm rou... SAPI and e...

Counter IED

IED Change Detection

- *System tested at Yuma on UH-1, Apache, Shadow*
- *1 system fielded Jan 05;*

Vehicle Protection

Vehicle Protection: Expedient Armor* for Standard HMMWVs

- *Fielded for Operation Iraqi Freedom with initial fielding in November 2003*
- *ARL developed mechanology solution, TARDEC refined the design and integrated it into the vehicle and the Tank-automotive and Armaments Command's Ground Systems Industrial Enterprise is now taking the resultant technical data package and making the kits in quantity*
- *Has saved lives from both small arms and IED attacks*
- *Production of the HMMWV kits complete*



First Convoy of Expedient Armor Equipped HMMWVs arrives in Iraq



Occupants survived IED Attack



**Expedient Armor is NOT being put on uparmored HMMWVs*

- *13,941 High Mobility Multipurpose Wheeled Vehicle (HMMWV) armor survivability kits produced*
  - *12,892 Installed*
- *3,561 Heavy Tactical Vehicle (HTV) kits produced*
  - *3,073 Installed*
- *1,864 Medium Tactical Vehicle (MTV) kits produced*
  - *1,525 Installed*

- *1025 Stryker Kits produced - 930 kits presently deployed in 3 brigades*
- *60 M1 Kits Built*

Vehicle Protection-Stryker Bar Armor

- *Developed by GDLS*
- *This armor is in use on the Strykers in Iraq. In 2004 (first fielded in 2003)*
- *Bar Armor requires at least ~10-12" of distance from robust base armor to be effective*
- *Bar armor is intended to damage the RPG, to prevent the formation of a "Shaped Charge Jet". Bar spacing based on destroying RPG without "arming" it.*
- *Even in "Successful Defeat of RPG", there will still be an explosive blast. This is why you need a protective layer of robust armor*







Using technology from past investments

Exploiting opportunities from current investments

Leveraging Scientist & Engineer expertise

"We do not want to wait for perfect solutions"
- GEN Abizaid

S&T Products Fielded through the Rapid Equipping Force

Communications Electronics RDEC



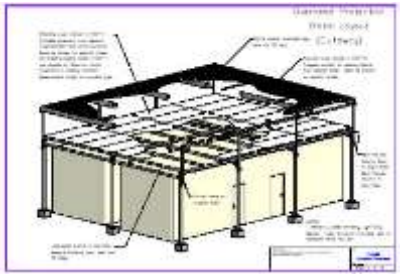


Jammers



Breadcrumb—
wireless repeater

Engineer RDC



BACKSTOP

DARPA



BOOMERANG

Sandia National Lab



GAUNTLETS

Armaments RDEC



CROWS Lite

Army Research Lab

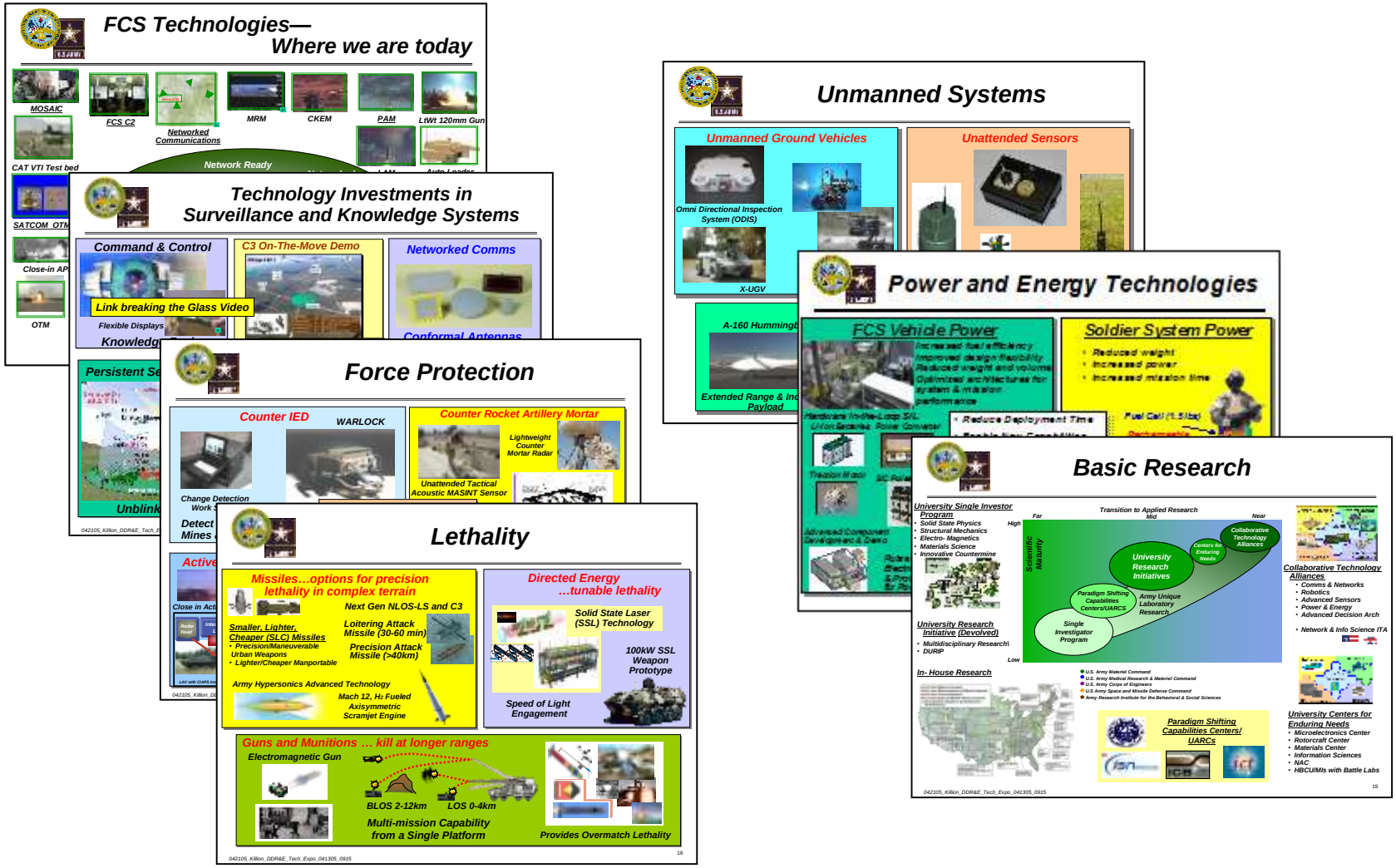






HUNTER/KILLER

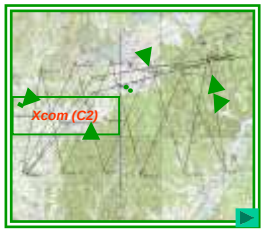
Major S&T Investments



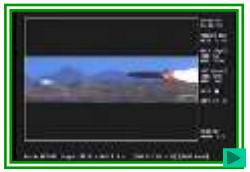
FCS Technologies—
Where we are today


Multi function OTM Secure Adaptive Integrated Comms


FCS C2



Networked Communications


Mid Range Munition


Compact KE Missile


Precision Attack Msl


Loiter Attack Msl


CAT VTI Test bed


LtWt 120mm Gun


SATCOM On The Move


Auto Loader


Close-in Active Protection Sys (APS)


Hummingbird


On The Move APS


Adv Armor

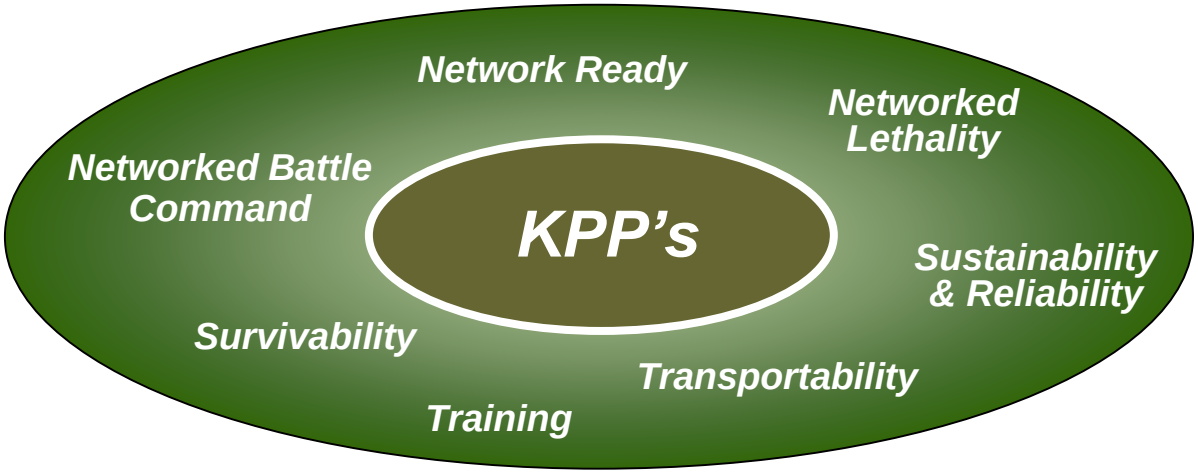

KE APS


Change Detection


UGV


Spinner-Mobility


Micro Air Vehicle



Technologies for the Current & Future Force

Technology Transition Agreements

Documents acquisition program needs for Critical Technologies under development by the S&T community

Key elements:

- ***Program Requirements***
- ***Technology Maturation Plans***
- ***Milestones & Schedule***
- ***Funding***

FCS Technology Transition Agreements

- *Security Systems and Algorithms (CT3B2)*
- *Dynamic Sensor-Shooter Pairing Algorithms & Fire Control (CT14)*
- *Recoil Management & Light Weight Cannon (CT17)*
- *Distributive Collaboration of Manned/Unmanned Platforms (CT18)*

- *Water Generation and Purification (CT22A)*
- *Survivability (CTs 25A, 25B & 27)*
- *Signature Management (CT26)*
- *Power Distribution and Control (CT29)*
- *Manned Ground Vehicle High Density Packaged Power (CT31)*

Technology Investments in Surveillance and Knowledge Systems

Command & Control



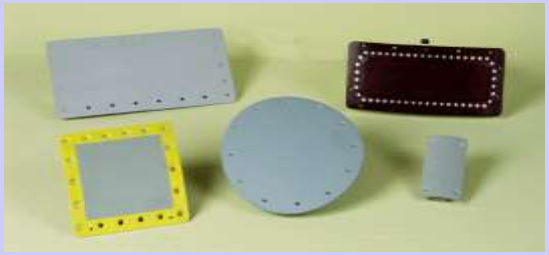
Flexible Displays

Knowledge Fusion

C3 On-The-Move Demo



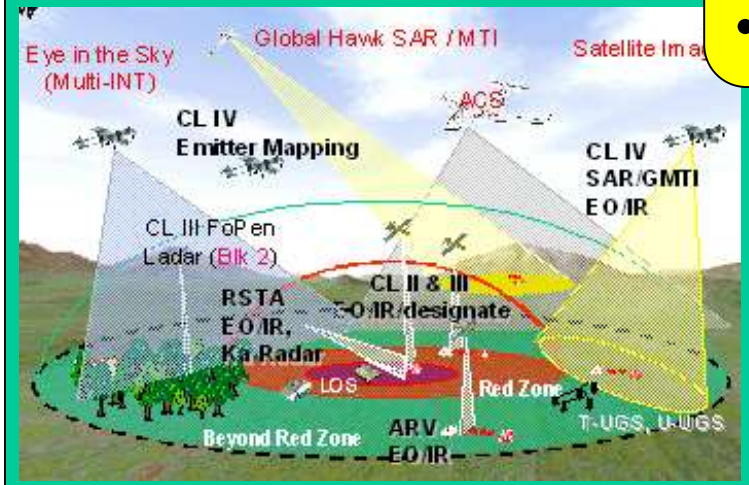
Networked Comms



Conformal Antennas

- Find the Enemy
- Assured Comms
- Battle Command

Persistent Sensor Coverage



Unblinking "Eye"

Portable SA for the Soldier



Disposable Sensors

Improved MOUT SA



Through Wall Sensing

Force Protection

Counter IED

WARLOCK





Change Detection Work Station

Detect & Neutralize Mines & "Booby Traps"

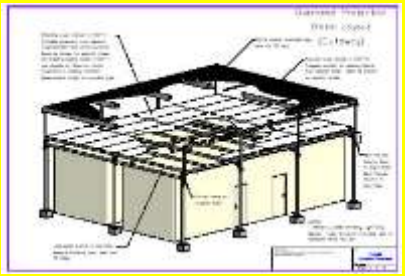
Counter Rocket Artillery Mortar



Unattended Tactical Acoustic MASINT Sensor

Lightweight Counter Mortar Radar





Backstop

Soldier Protection



Deltoid Axillary Protection



SAPI Plates

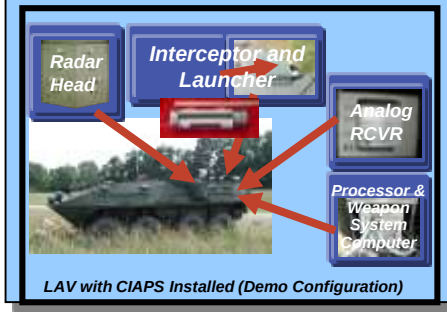


Interceptor

Active Protection



Close in Active Protection System (APS)



LAV with CIAPS Installed (Demo Configuration)



KE APS

Light Weight Armor











Structural, Electromagnetic, and Smart Armors

Lethality

Missiles…options for precision lethality in complex terrain





Next Gen NLOS-LS and C3

Loitering Attack Missile (30-60 min)



Precision Attack Missile (>40km)



Smaller, Lighter, Cheaper (SLC) Missiles

- *Precision/Maneuverable Urban Weapons*
- *Lighter/Cheaper Manportable*

Army Hypersonics Advanced Technology



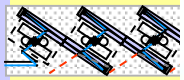
Mach 12, H_2 Fueled Axisymmetric Scramjet Engine



Directed Energy …tunable lethality



Solid State Laser (SSL) Technology





100kW SSL Weapon Prototype



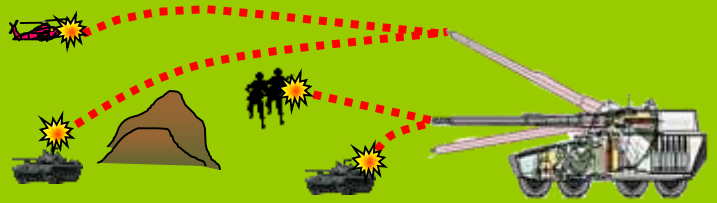
Speed of Light Engagement

Guns and Munitions … kill at longer ranges

Electromagnetic Gun







BLOS 2-12km **LOS 0-4km**

Multi-mission Capability from a Single Platform



Provides Overmatch Lethality

Unmanned Systems

Unmanned Ground Vehicles



Omni Directional Inspection System (ODIS)





Talon Robot



X-UGV

Unattended Sensors









Unmanned Air Vehicles

A-160 Hummingbird



Extended Range & Increased Payload

Organic Air Vehicle (OAV)



Extended Range & Endurance

Micro Air Vehicle (MAV)



Extended Loiter "Perch & Stare"

Power and Energy Technologies

FCS Vehicle Power



Increased fuel efficiency
Improved design flexibility
Reduced weight and volume
Optimized architectures for system & mission performance

Hardware In-the-Loop SIL

Li-Ion Batteries



Power Converter



Traction Motor



SiC Pulse Switch



- *Reduce Deployment Time*
- *Enable New Capabilities*
  - *Lethality*
  - *Survivability*
  - *Situational Awareness*
- *Improve Sustainment*
  - *Extend Mission Time*

Advanced Component Development & Demo



Pulse Power for...
Electric Weapons & Protection…
6x Power Density

Fuel Cell Diesel Reformer



Soldier System Power

- *Reduced weight*
- *Increased power*
- *Increased mission time*



Fuel Cell (1.5 lbs)

Rechargeable Battery Belt (1 lbs)

Battery Pack



Methanol Canister (1.5 lbs)



Rapid Smart Chargers





Microengines



5X-10x Power Density

Basic Research

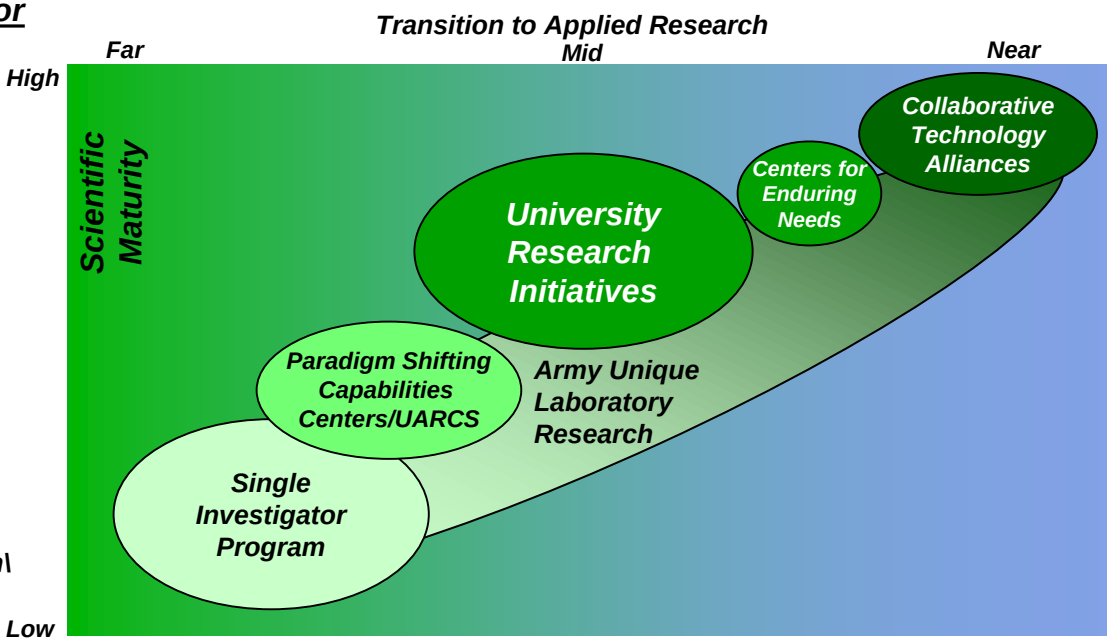
University Single Investor Program

- Solid State Physics
- Structural Mechanics
- Electro- Magnetics
- Materials Science
- Innovative Countermine



University Research Initiative (Devolved)

- Multidisciplinary Research\
- DURIP



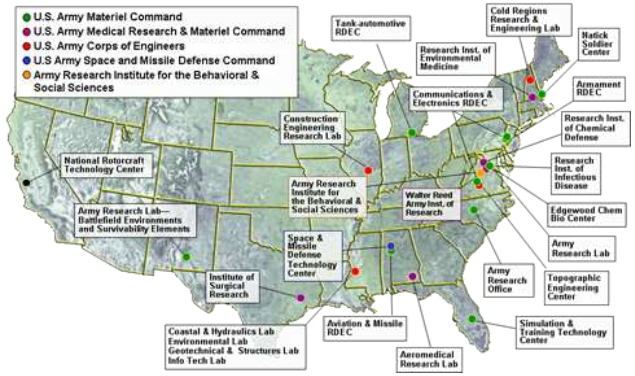


Collaborative Technology Alliances

- Comms & Networks
- Robotics
- Advanced Sensors
- Power & Energy
- Advanced Decision Arch

- Network & Info Science ITA

In- House Research



- U.S. Army Materiel Command
- U.S. Army Medical Research & Materiel Command
- U.S. Army Corps of Engineers
- U.S Army Space and Missile Defense Command
- Army Research Institute for the Behavioral & Social Sciences

Paradigm Shifting Capabilities Centers/ UARCs

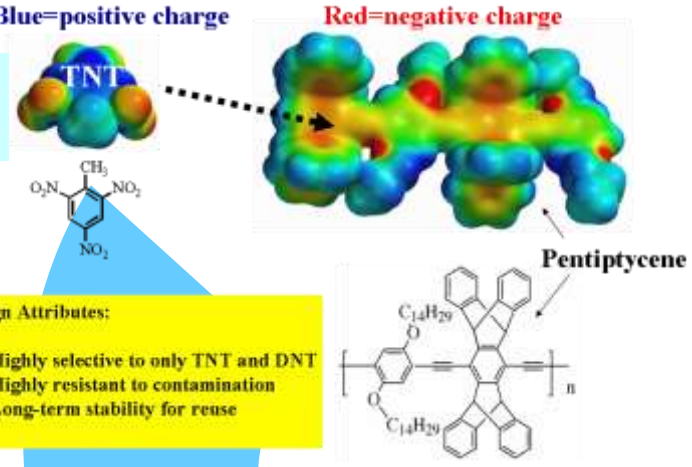


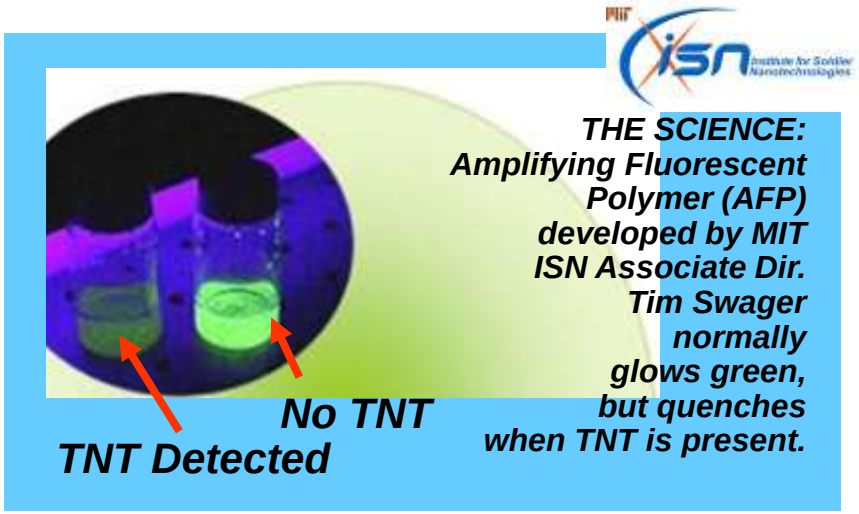
University Centers for Enduring Needs

- Microelectronics Center
- Rotorcraft Center
- Materials Center
- Information Sciences
- NAC
- HBCU/MIs with Battle Labs

GWOT – FIDO's Contribution

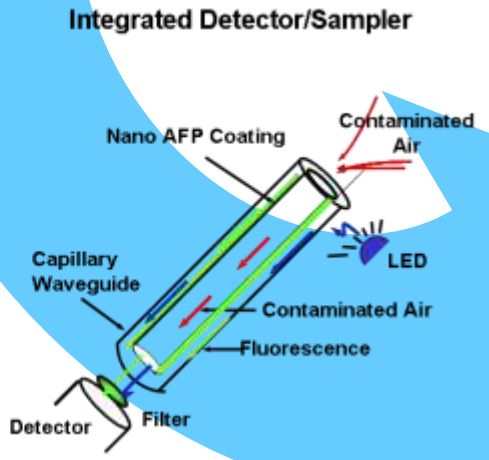
Molecular Engineering







- Rugged
- Handheld
- Lightweight
- Easy to operate
- Audio and visual indications



FIDO Units in Iraq for Evaluation (Aug 04) – Dragon Runner & Handheld





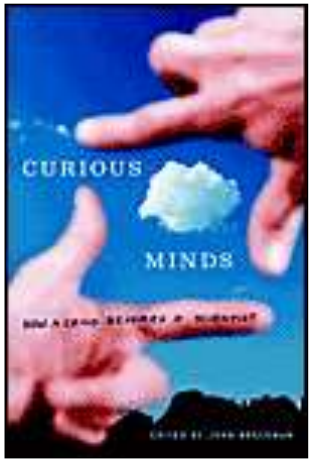
Creating the Future: Curiosity & Imagination

"I was born to be a theoretical physicist."
Paul Davies

"This, then, was the religion I was raised in: veneration for human creativity and the power of ideas." *Ray Kurzweil*

"What has mattered most was doing something creative and lasting." *Lee Smolin*

"How did I wind up as a scientist? By all logic, I should start with Gilligan's Island, a sitcom that entranced me when I was an eight-year-old growing up in Brooklyn." *Robert Sapolsky*

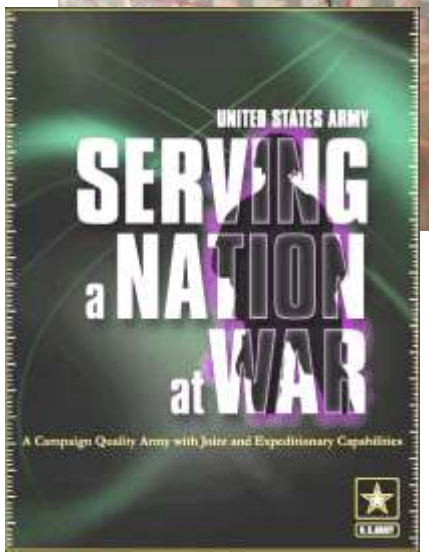




"Every great advance in science has issued from a new audacity of imagination." *John Dewey*

The Army…
Transforming while at War







"…this may mean making the difficult decision of foregoing currently planned systems and investing instead in capabilities that we believe will reduce future risk."

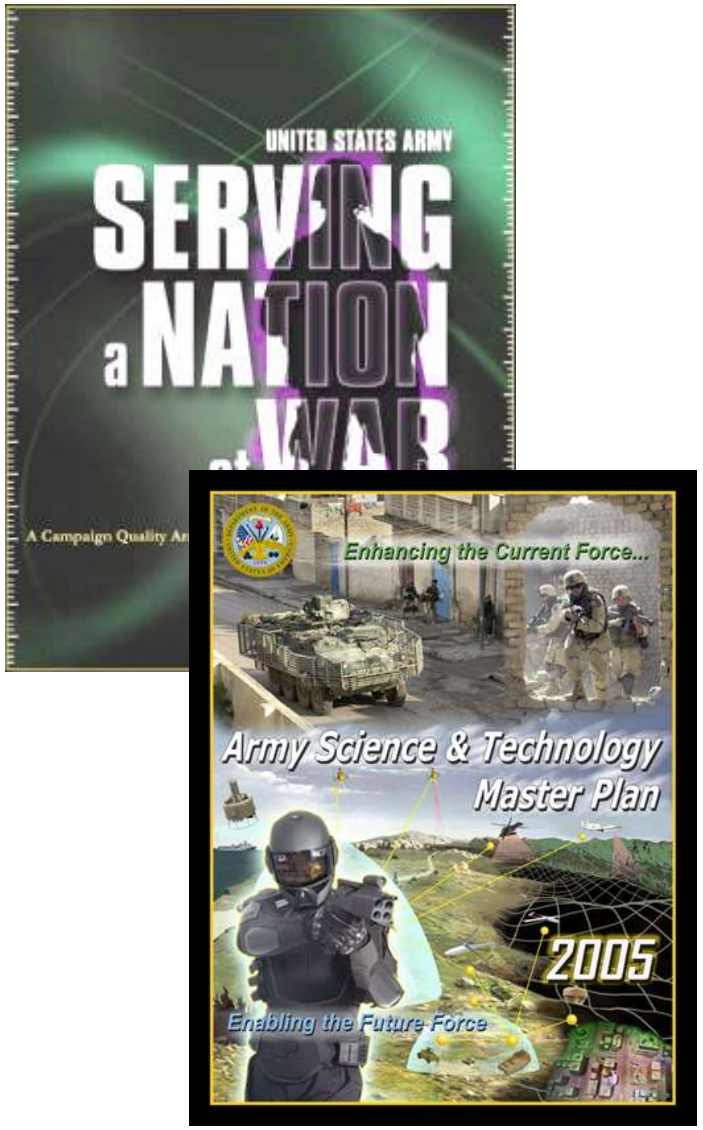
Secretary Rumsfield

"Finally, the nature of expeditionary operations argues for leveraging every potential tool of speed, operational reach, and precision."

Army Science & Technology

S&T Executives Perspective—Focusing on Warfighter needs

20 April 2005



Dr. Thomas Killion
Deputy Assistant Secretary for Research and Technology/ Chief Scientist

Army S&T Vision—
Pursuing Transformational Capabilities
Speed, Reach, and Precision

Current Force



~100 lb. load



70+ tons





< 10 mph

From Platforms to System of Systems

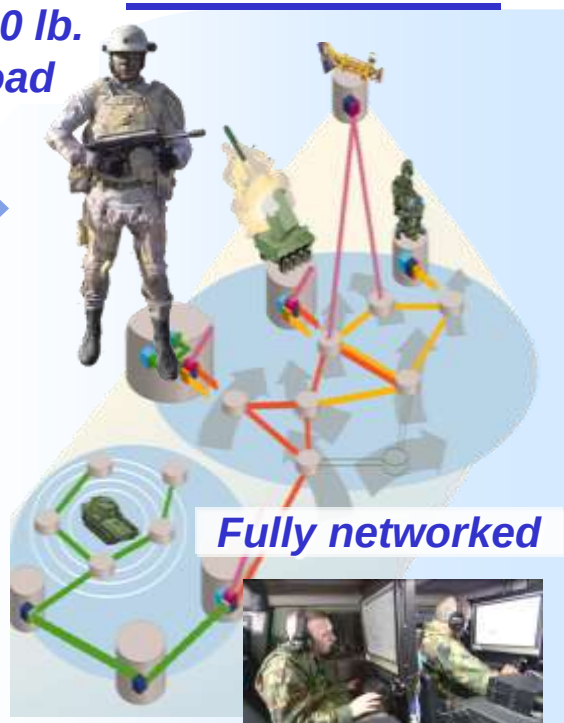
Enabling the Future Force



Enhancing the Current Force

Future Force

< 40 lb. load



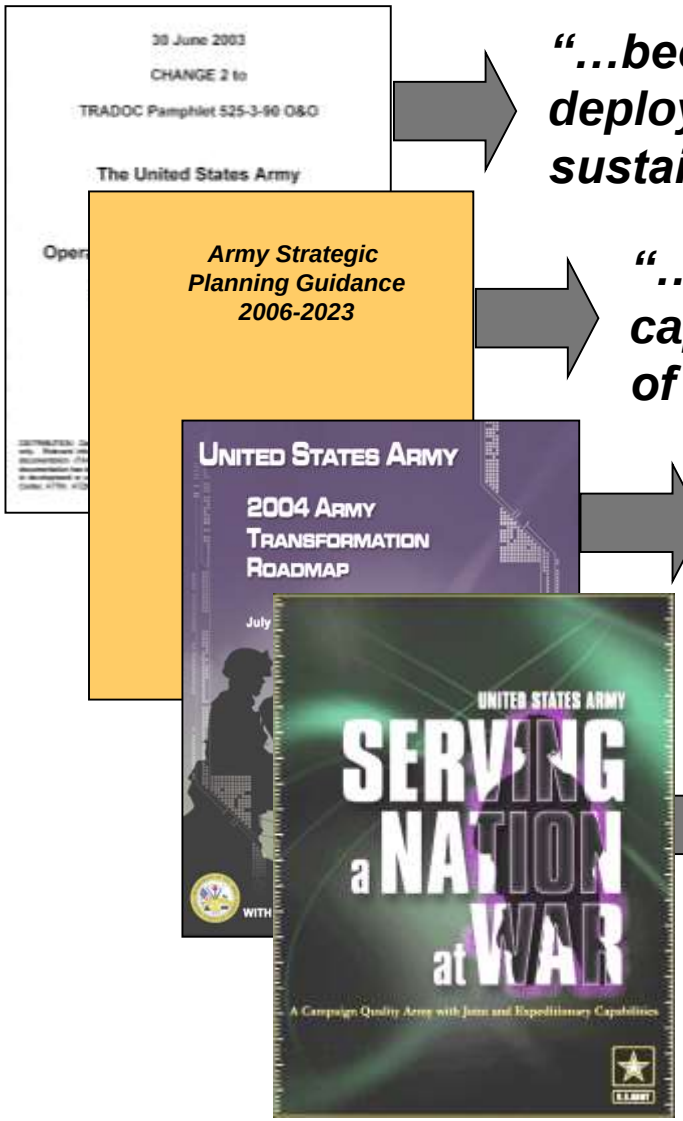
Fully networked

< 20 tons



> 40 mph

Responding to Army Needs



"…become a more strategically responsive, deployable, agile, versatile, lethal, survivable, and sustainable force, effective in all situations …"

"…provide relevant and ready land power capability to the Combatant Commander as part of the Joint Team"

"…provide dominant land power to the Joint Force now and into the future."

"…change in time of war must deal simultaneously with both current and future needs"

Army S&T Program Drivers—
Current and Future Force Capability Gaps

Emerging Top Challenges for Current Force

- Improve Soldier Protection in Counter-Insurgency Environment
- Provide Prototype Network Enabled Battle Command to Current Force
- Provide Responsive, Networked, Precision Fire
- Protect the Force in Non-Contiguous Battlespa
- Improve Non-Lethal Capabilities for the Curren
- Improve Ability of Current Forces to Conduct J
- Expand HUMINT Capabilities
- Increase Ability and Speed of Analysis and Inf
- Increase Army Ability for Sustained, High Oper
- Improve SOF and Conventional Forces Integra

Top Ten Future Required Capabilities from Capabilities Needs Assessment

- Enhance Soldier Protection
- Provide Effective C^2 Throughout All Phases of Ops; Any Location
- Enhance Platform Protection
- Provide C^4 Architecture – Fully Functional in all Conditions, LOS/NLOS
- Provide Modular, Tailorable Forces Rapidly Deployable in Mission Config
- Lethality Overmatch – Any Enemy LOS/BLOS/NLOS, All Conditions
- Allow Train as you Fight, Operating Similar at both CTCs & Home Station
- Provide Superior ISR – Modular, Scalable, Tailored Battlefield Awareness
- Provide Enhanced Countermine (CM) Capabilities
- Provide Modular Forces Tailored for Self-Sufficiency and Endurance

15

GWOT Capabilities Provided by S&T

Soldier Protection

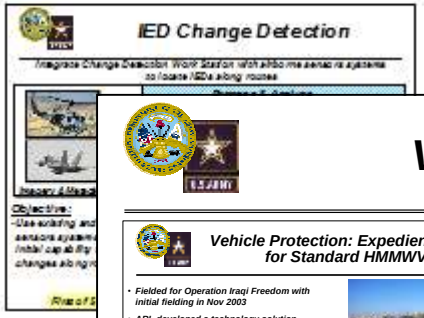


Interceptor Body Armor is a modular, multi-threat Body Armor using an Outer Tactical Vest (OTV) and Small Arms Protective Insert (SAPI) Plates

- *Key Technologies: Advanced high performance*

7.62 mm rou… SAPI and e…

Counter IED



- *System tested at Yuma on UH-1, Apache, Shadow*
- *1 system fielded Jan 05;*

Vehicle Protection

Vehicle Protection: Expedient Armor* for Standard HMMWVs

- *Fielded for Operation Iraqi Freedom with initial fielding in Nov 2003*
- *ARL developed a technology solution, TARDEC refined the design and integrated it into the vehicle and the Tank-automotive and Armaments Command's Ground Systems Industrial Enterprise is now taking the resultant technical data package and making the kits in quantity*
- *Has saved lives from both small arms and IED attacks*
- *Production of the final 2,500 HMMWV kits continues ahead of schedule with completion in Mar 2005*



First Convoy of Expedient Armor Equipped HMMWVs arrives in Iraq



Occupants survived IED Attack



**Expedient Armor is NOT being put on up-armored HMMWVs*

- *13,803 High Mobility Multipurpose Wheeled Vehicle (HMMWV) armor survivability kits produced*
  - *–10,725 installed*
- *1,082 Heavy Expanded Mobility Tactical Truck (HEMTT) kits produced*
  - *–701 installed*
- *750 Family of Medium Tactical Vehicles(FMTV) kits produced*
  - *–621 installed*

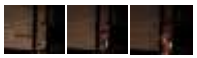
- *1025 Stryker Kits produced - 930 kits presently deployed in 3 brigades*
- *60 M1 Kits Built*

Vehicle Protection-Stryker Bar Armor

- *Developed by GDLS*
- *This armor is in use on the Strykers in Iraq in 2004 (installed in 2003)*
- *Bar Armor requires at least ~10-12" of distance from robust base armor to be effective*
- *Bar armor is intended to damage the RPG, to prevent the formation of a "Shaped Charge Jet". Bar spacing based on destroying RPG without "arming" it*
- *Even in "Successful Defeat of RPG", there will still be an explosive blast. This is why you need a protective layer of robust armor*







Using technology from past investments

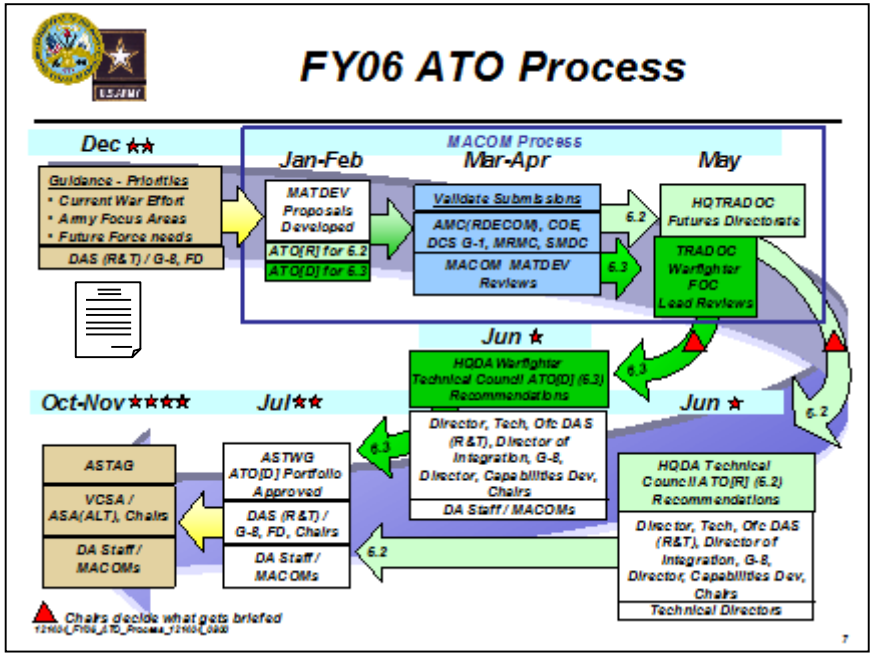
Exploiting opportunities from current investments

Leveraging Scientist & Engineer expertise

"We do not want to wait for perfect solutions"
- GEN Abizaid

Army Technology Objective (ATO) Process

- *HQDA Guidance—to shape program priorities for new proposals*
- *ATO(Demonstration) programs require Force Operating Capability (FOC) lead (Combat Developer) endorsement—WTC review*
- *ATO(Research) programs require HQTRADOC Director, Capabilities Development validation—Technical Council Review*
- *WTC/TC chairs determine which programs are briefed—Fact Sheet information identifies need for briefing*
- *Army S&T Working Group—HQDA 2 star review and approval*



ATO[Demonstration] = 6.3
ATO[Research] = 6.2

Senior Leader Engagement

ASTWG (Army S&T Working Group)

CO-CHAIR: DAS(R&T) / G-8 FD

- TRADOC (Futures Center)
- RDECOM
- SMDC
- MRMC
- USACE
- DAS(DE&C)
- Dep, Sys Mgt
- PAE
- ODCS G-1
- ODCS G-2
- ODCS G-3
- ODCS G-4
- ODCS G-6
- ATEC
- ACSIM

PEOs as Acquisition Council

TDs as Technical Council

Initiatives

- Army Technology Objectives
- Advanced Technology Demonstrations
- Army S&T Master Plan
- Strategic Research Objectives

ASTAG (Army S&T Advisory Group)

CO-CHAIR: ASA (ALT) / VCSA

- CG, AMC
- CG, FORSCOM
- CG, USACE
- CG, TRADOC
- CG, SMDC
- DCS G-1
- DCS G-2
- DCS G-3
- DCS G-4
- CIO/DCS G-6
- DCS G-8
- TSG
- ASA (ALT) MILDEP
- DUSA(OR)
- Dir, TRADOC Futures Center

OSD DDR&E

DSTAG (Defense Science & Technology Advisory Group)

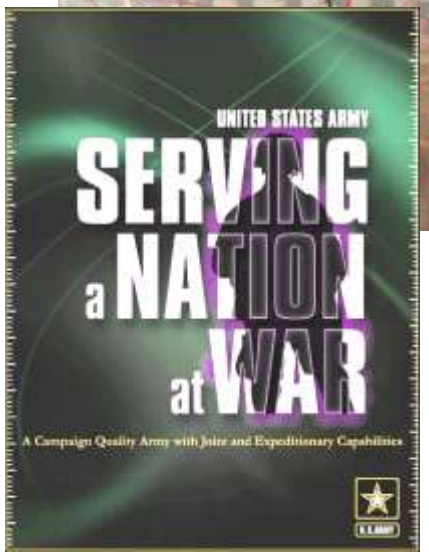
Initiatives

- Defense S&T Strategy
- ACTDs
- TARA Reviews
- DTAP/JWSTP
- Defense Tech Objectives

S&T / Warfighter / PEO Partnership

The Army…
Transforming while at War







"…this may mean making the difficult decision of foregoing currently planned systems and investing instead in capabilities that we believe will reduce future risk."

Secretary Rumsfield

"Finally, the nature of expeditionary operations argues for leveraging every potential tool of speed, operational reach, and precision."

This Briefing is Classified

UNCLASSIFIED

Integrated Solutions to Deter/Defeat Threats to U.S.

COL Klooster
NORAD-USNORTHCOM/J6D

19 April 2005

USNORTHCOM Mission

Conduct military operations to –

- **Deter, prevent and defeat threats to the United States, its territories and interests within assigned area of responsibility**

- **Provide support to civil authorities, including consequence management operations**
  - **As directed by the President or Secretary of Defense**



Vision Statement

"Deter, Prevent, Defeat, Mitigate"

"Protecting Americans Where They Live and Work"

UNCLASSIFIED

Protecting the Homeland

Unique Area of Responsibility

Specialized Capabilities

DoD's #1 Priority

Extraordinary Circumstances

Emergency Circumstances

Temporary Circumstances

Homeland Defense

Civil Support





Execute OPLANS



Special Events





Support to Counter Narcotics



Domestic Disaster Relief



Domestic Civil Support



CBRNE Incident Mgmt

Civil Support

- **Maintain situation awareness**
- **Anticipate requests**
- **Respond with unique capabilities**
- **Always in support of a Primary Agency**





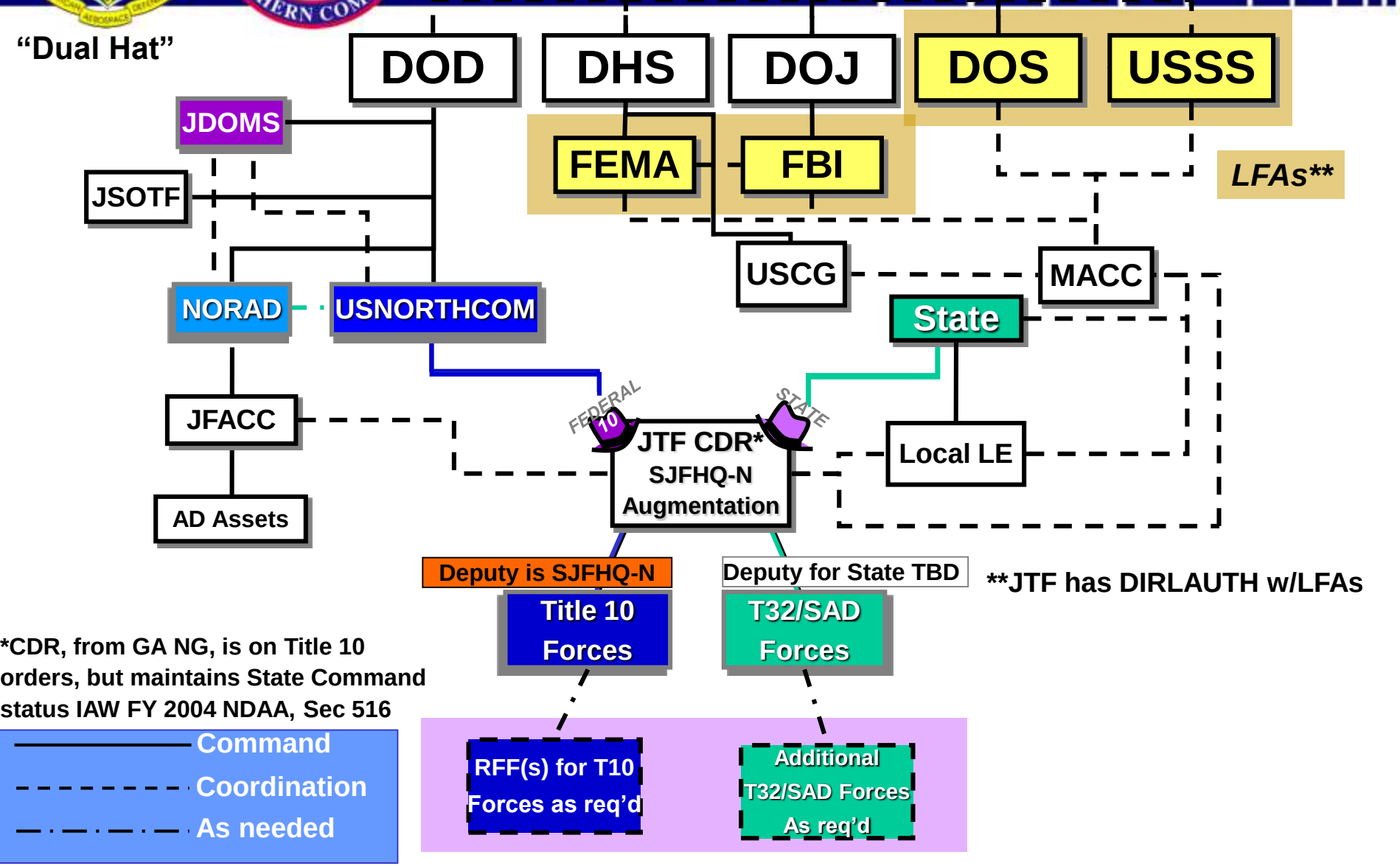
Save Lives, Prevent Injury,
Provide Temporary Critical Life Support

Our Coalitions and Operations

- **Traditional coalitions based on treaty or alliance**
  - Structured agreements
  - Build plans and exercise capabilities
- **Our coalitions are event dependent**
  - May not get to choose who or where—different processes, procedures
  - May not get to negotiate or plan in advance—limited exercise experiences
  - May differ by phase—or even skip phases
- **Expanding Joint Force employment definitions**
  - Joint Task Force North (JTF-N)
  - Joint Task Force Civil Support (JTF-CS)
  - Standing Joint Force Headquarters National Capitol Region (SJFHQ NCR)
  - JTFs for National Special Security Events (State of the Union Address, G8-Summit, Democratic and Republican National Conventions…)

USNORTHCOM coalition is largely an Interagency equation

Approved C^2 for G8 - "Dual Hat"



Our "Need to Share" Construct

- **Principles**
  - Be inclusive--focus on commonality first, differences second
  - "Grow into a solution, not buy an answer"
  - "Think big, start small, scale fast"
  - Focus on culture and process first, technology second
- **Strategy**
  - Leverage existing information sharing capabilities—don't buy more infrastructure
  - Base standards on the acceptability within the HLS/D community—keep simple and eliminate locally developed applications
  - Focus on event-based prevention, response and mitigation, adapt to changing list of partners
  - Mature Net-centric operating environment beyond DoD systems

Information Sharing is Central to USNORTHCOM Mission

Enterprise Architecture Guideposts

- **NORAD-USNORTHCOM Enterprise Architecture requires:**
  - Innovative thinking and engineering approaches
  - Ability to model our new mission area
    - cross traditional boundaries (Need to Share vs. Need to Know paradigm)
    - Expanding mission partners (Interagency, State, Local….)
- **Not a tool or technology, but rather a process**
  - Accounts for culture, people and socio-physiological needs of the organization
  - Addresses the challenge, “what components of Enterprise Architecture will add value now and in the long run?”
- **Provides a mutually shared concept across disciplines, systems and missions**

Focus first on mission, processes, procedures and data composition; followed by systems and technologies

Our Enterprise Architecture Environment

- **Current decision support systems are designed for vertical information sharing**
  - Works well for traditional military structures and law enforcement
  - We require vertical and horizontal information sharing and the ability to transition between these two realms—enables coordinated decisions across military and civilian command structures
- **Planning for upcoming events and reacting to emerging crises requires:**
  - Correlating various incidents and alerts from multiple information sources
  - Sharing of information resources
- **Our environment demands current IT solutions (e.g. portal)**
  - Automated filter and fusion applications to integrate vast amounts of data and information into patterns and displays
  - Correlate disparate bits of information and “connect the dots”

Events drive our information sharing efforts


NORTH AMERICAN AEROSPACE DEFENSE COMMAND


UNITED STATES
NORTHERN COMMAND



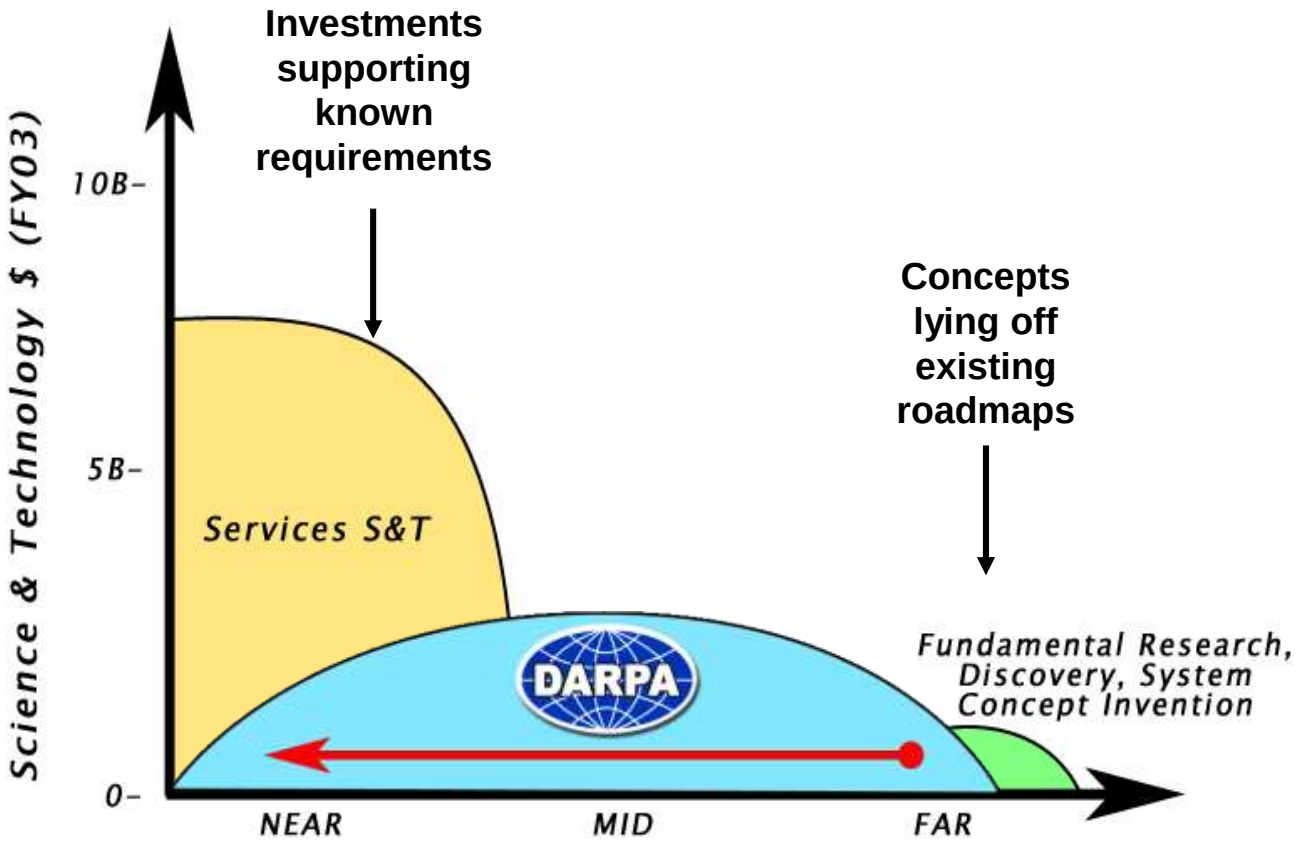
DARPA's S&T Program

NDIA 6th Annual Science & Engineering Technology Conference

Charlestown, SC April 21, 2005

Dr. Robert Leheny
Deputy Director

DARPA's Role in Defense Science & Technology



DARPA sponsoring revolutionary, high-payoff research that <u>bridges the gap</u> between fundamental discoveries and their military use

Maintaining the technological superiority of the U.S. military while preventing technological surprise from harming our national security

DARPA Organization

Director, Tony Tether
Deputy Director, Bob Leheny

Information Exploitation
Ted Bially
Bob Tenney/Bob Popp

- **Sensors**
- **Exploitation Systems**
- **Command & Control**

Tactical Technology
Art Morrish
Gary Graham/Stephen Welby

- **Air/Space/Land Platforms**
- **Unmanned Systems**
- **Space Operations**
- **Laser Systems**
- **Future Combat Systems**
- **Planning / Logistics**

Special Projects
Amy Alving
Joe Guerci

- **Chem/Bio Def Systems**
- **Counter Underground Facilities**
- **Space Sensors/Structures**
- **Navigation/Sensors/ Signal Processing**

Advanced Technology
Dave Honey
Larry Stotts

- **Assured C3ISR**
- **Maritime**
- **Early Entry/Special Forces**

Joint Unmanned Combat Air Systems
Mike Francis

- **Common Systems & Technologies**
  - **X-45 System**
  - **X-47 System**

Defense Sciences
Steven Wax
Brett Giroir

- **Bio Warfare Defense Technologies**
- **Biology**
- **Materials & Devices**
- **Mathematics**

Information Processing Technology
Ron Brachman
Barbara Yoon

- **Cognitive Systems**
- **Computational - Perception**
- **Representation & Reasoning**
- **Learning**
- **Natural Communication**

MicrosystemsTechnology
John Zolper
Dean Collins

- **Electronics**
- **Optoelectronics**
- **MEMS**
- **Combined Microsystems**

DARPA's Strategic Thrusts

Investments Today for Future Capabilities

- Detection, Precision ID, Tracking, and Destruction of Elusive Surface Targets
- Location and Characterization of Underground Structures
- Force Multipliers for Urban Area Operations
- Networked Manned & Unmanned Systems
- Robust, Secure Self-Forming Tactical Networks
- Cognitive Systems
- Bio Revolution
- Assured Use of Space

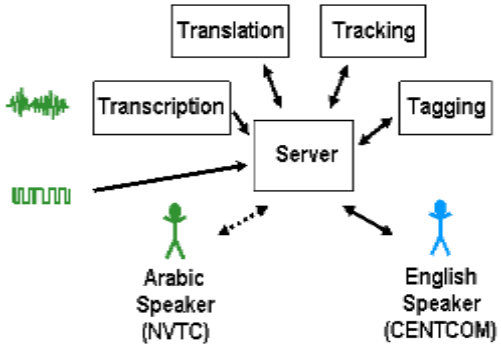
Technology Support to Deployed Forces

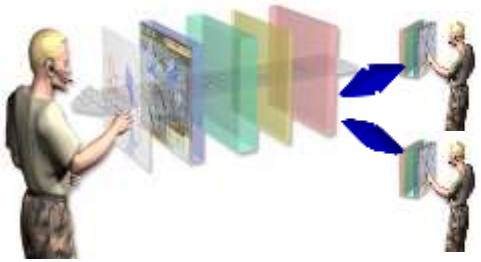
OEF/OIF DARPA Rapid Reaction Program



1. Water Pen
2. Translingual Information Detection, Extraction, & Summarization (TIDES)
3. Phraselator
4. CPOF
5. Boomerang
6. Marine Airborne Retransmission System (MARTS)
7. Enhanced Combat Training













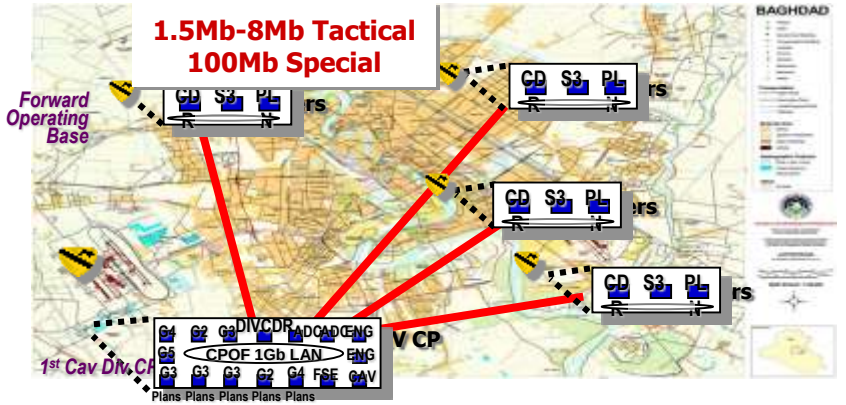
Quick Reaction Support for Operation Enduring Freedom

- Boomerang
- Counter-RPG
- Marine Airborne Re-Transmission System
- Command Post of the Future
- Advanced Sensing Technology
- Enhanced TIDES Reconstruction Report (eTIRR)
- Counter-IED Methods

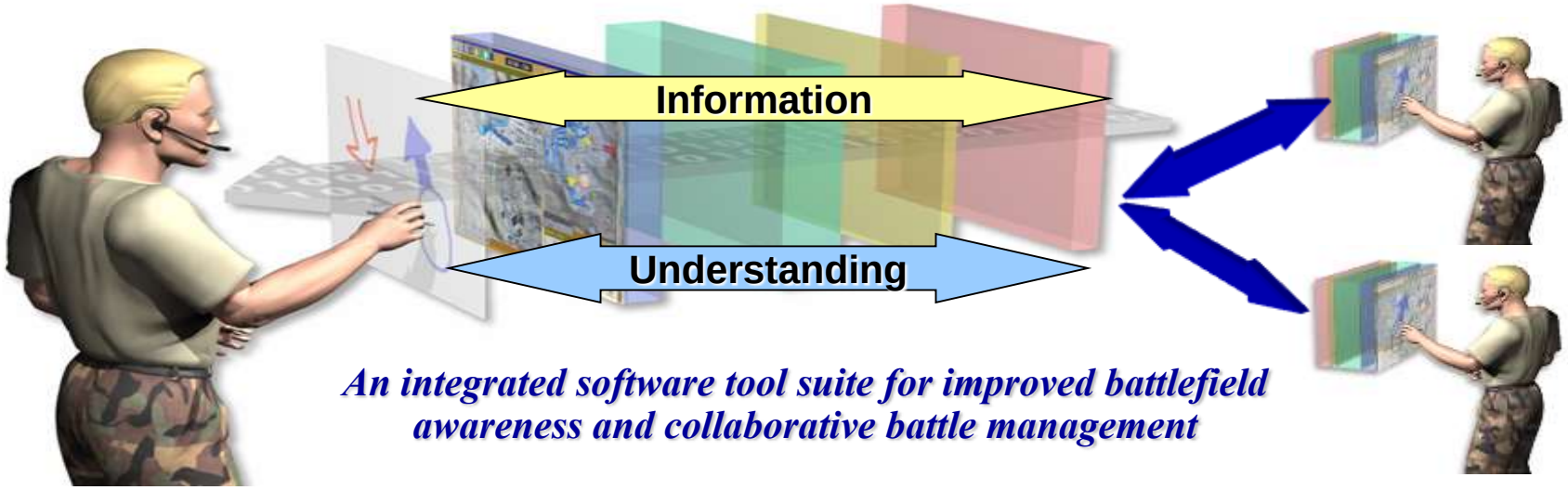


DARPA TIDES Iraq Reconstruction

No. 202, 21 May, 2004



Command Post of the Future

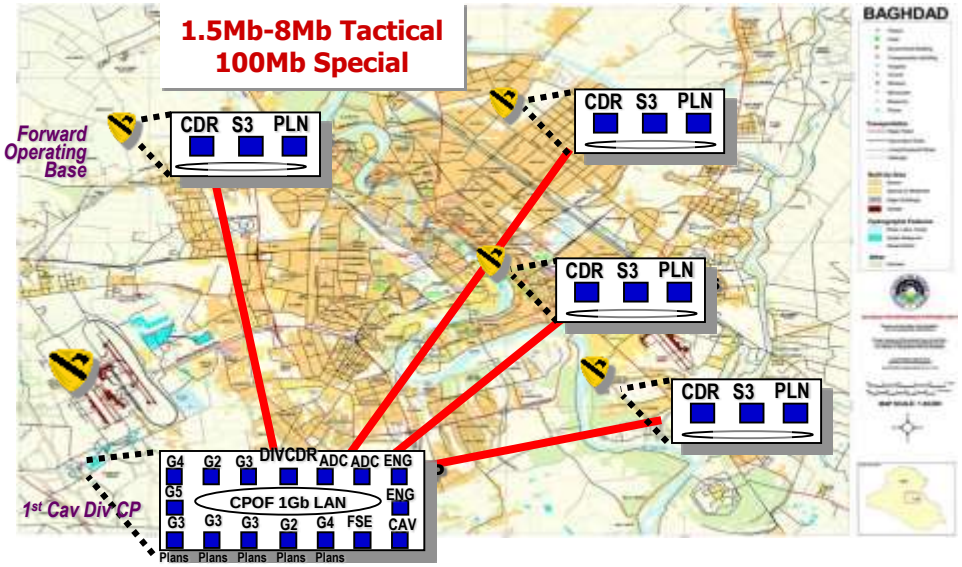


An integrated software tool suite for improved battlefield awareness and collaborative battle management

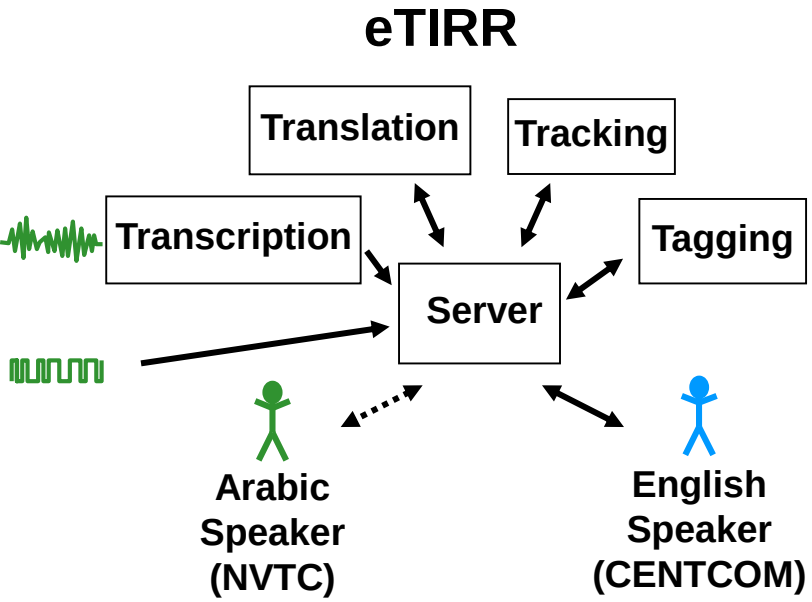
Distributed collaboration enables the elimination of place-based command posts.

Commanders and staff can be distributed across the battlefield during all phases of tactical operations

CPoF Configuration for 1st Armored Cavalry Div Baghdad



Enhanced TIDES Iraq Reconstruction Report (eTIRR)



- Exploit DARPA-funded advances in transcription, translation, tracking, tagging
- Apply to high value Arabic & English speech & text streams
- Produce timely reports of news and opinion tailored to needs of commanders in Iraq (current TIRR is used by CENTCOM, CPA)

DARPA TIDES Iraq Reconstruction Report

No. 202, 21 May 2004

In this issue:

Top Stories

- Al Qaeda suspects 'have ties with Iraq', GULF DAILY NEWS (Bahrain), 20 May 04
- Occupation bombs Iraq wedding party, AL-JAZEERA.NET (Qatar), 20 May 04
- Straw Admits That Allies' Failure To Keep Accurate Record of Civilian Deaths is 'Odd', The INDEPENDENT (London), 19 May 04
- The American Failure, AL-HAYAH (London), in Arabic, 19 May 04
- Thousands Respond to Al-Sistani's Call for Demonstrations in Karbala, VOICE OF THE MUJAHIDIN (Clandestine), in Arabic, 1400 GMT, 19 May 04
- US raids ally's Baghdad offices, AL-JAZEERA.NET (Qatar), 20 May 04
- Why the neo-cons lost their pin-up boy, ASIA TIMES ONLINE (Hong Kong), 21 May 04
- 'Zarqawi group' claims killing of council head, JORDAN TIMES (Amman), 20 May 04
  - COMMUNIQUE No. (6) ISSUED BY ZARQAWI'S "ATTAWHID AND JIHAD GROUP" – MILITARY DEPARTMENT, MAY 17, 2004 [From the SITE Institute]

Enhanced Combat Training

Two Distinct Projects

"DARWARS"

New class of PC-based cognitive learning, available anytime, anywhere



- **Squad level, multi-player, PC game providing cognitive experience of convoy ambush**
- **Easily modified scenarios and after action review capability**

Deployed to 1st Brigade, 25th Infantry Division Stryker Combat Team

"It is as real as you can get without being in danger. I was in an ambush last year and I can see how this will help with training."

Rapid Tactical Language Training

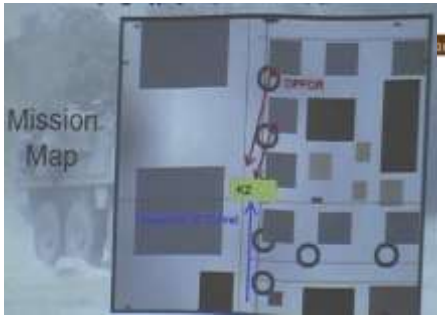
Tactical subset of language - gestures, culture, & survival vocabulary - for the soldier

"I learned more with this in one day than I did in an entire deployment in Iraq."

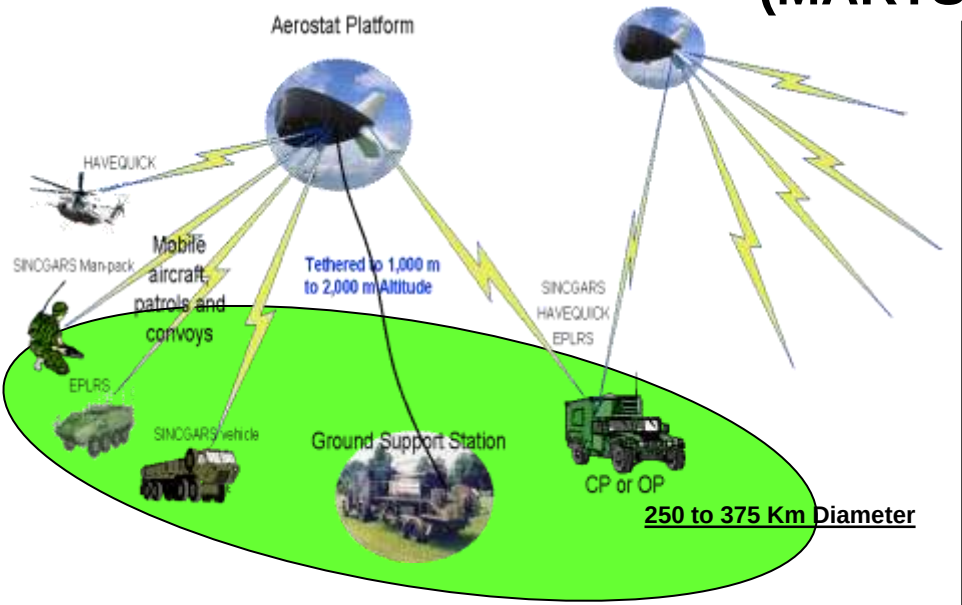
Deployed to 3rd Cavalry Regiment







Marine Airborne Re-Transmission System (MARTS)



Conceptual Layout



AN/PRC-117F

HAVEQUICK I/II
SINCGARS



AN/PSQ-2

EPLRS



Science Applications International Corporation
An Employee-Owned Company

NAVAIR

Aerostat Communications Relay connecting USMC SINCGARS, HAVEQUICK and ELPRS networks

Current Status

- **63K cu-Ft Aerostat GFEed to SAIC by NAVAIR late November 2004 (~400 lb+ payload)**
- **Upgraded Communications Payload and Ground Station to be integrated onto Aerostat during December 2004**
- **Training and Final Checkout schedule for January 15-31 before transfer to USMC for deployment to Iraq**

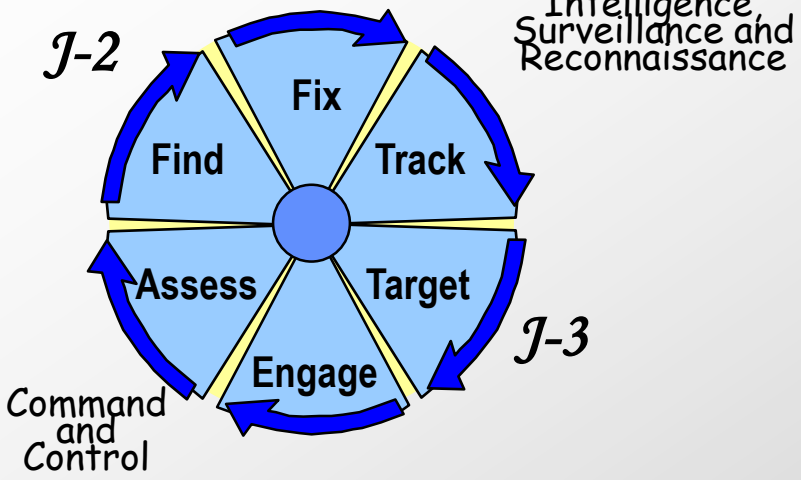
DARPA's Strategic Thrusts

Investments Today for Future Capabilities

- **Detection, Precision ID, Tracking, and Destruction of Elusive Surface Targets**
- Location and Characterization of Underground Structures
- Force Multipliers for Urban Area Operations
- Networked Manned & Unmanned Systems
- Robust, Secure Self-Forming Tactical Networks
- Cognitive Systems
- Assured Use of Space
- Bio Revolution

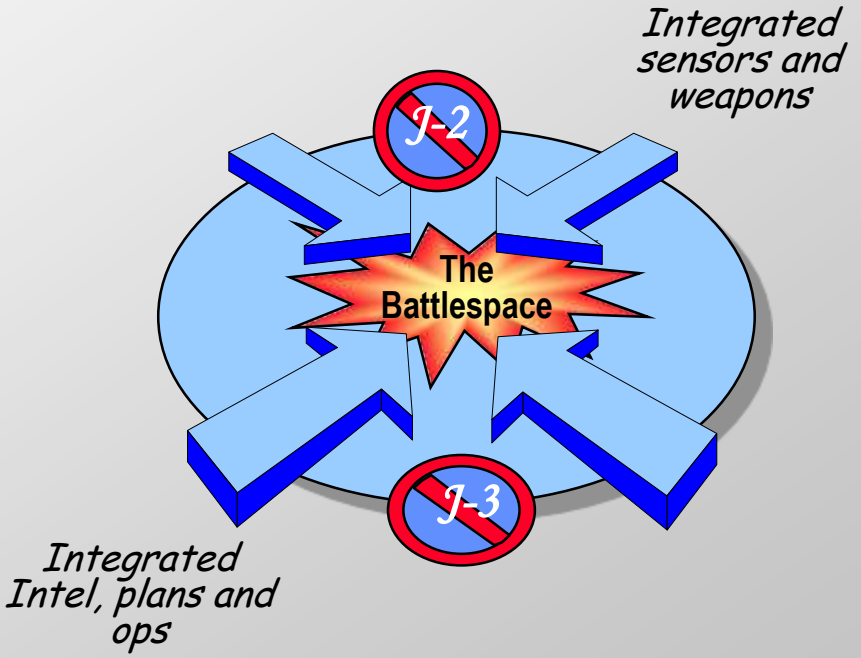
Technology Enabled C4KISR: Paradigm Shift

Current Paradigm



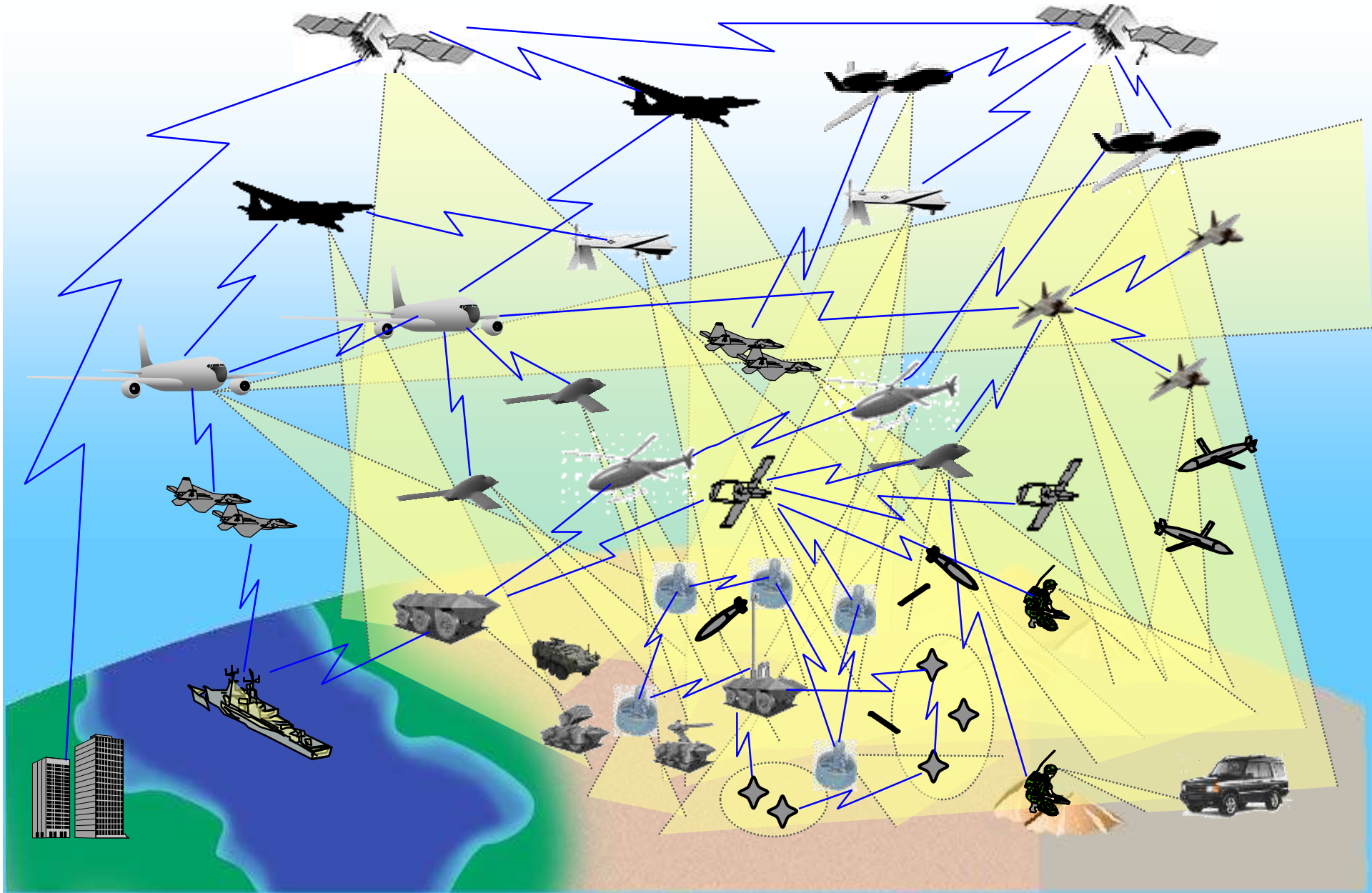
Sequential	Disjoint
Static	Rigid

New Paradigm



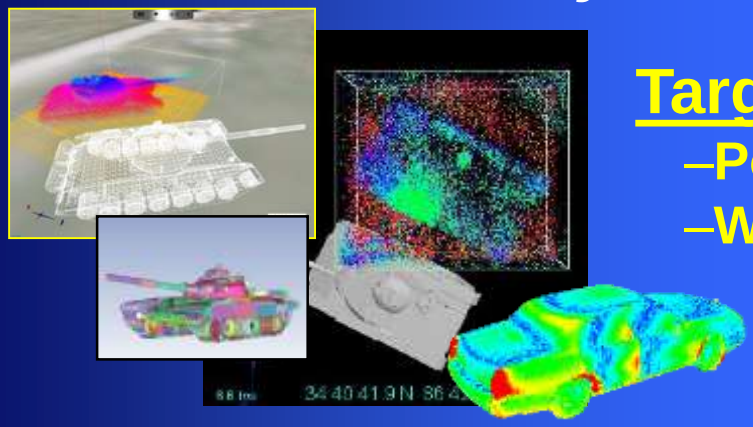
Uninterrupted	Continuous
Dynamic	Adaptive

Networked Operations



Information eXploitation Office

Key IXO Mission Thrusts

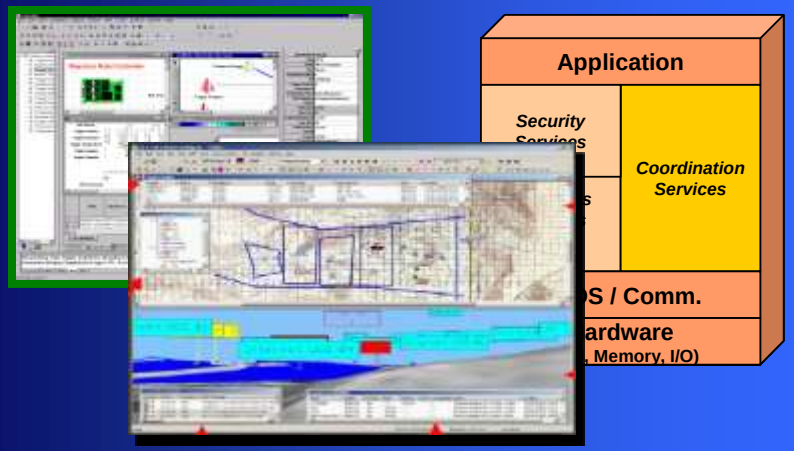


Target Understanding

- –Positive Combat ID
- –Weapons Effectiveness Assessment

Situation Awareness

- –Complex Environments
- –Real Time
- –All Levels of Command





System Management

- –Command and Control
- –Federated Systems
- –New Paradigms

Advanced Technology Office

Enabling Mobile Network-Centric Warfare



Robust, Self-Forming, Self-Defending Tactical Networks

Assured connectivity, including spectrum access, in all environments

Immediate network set-up and inherent flexibility to adjust as nodes enter and exit the network -- far fewer comms personnel required

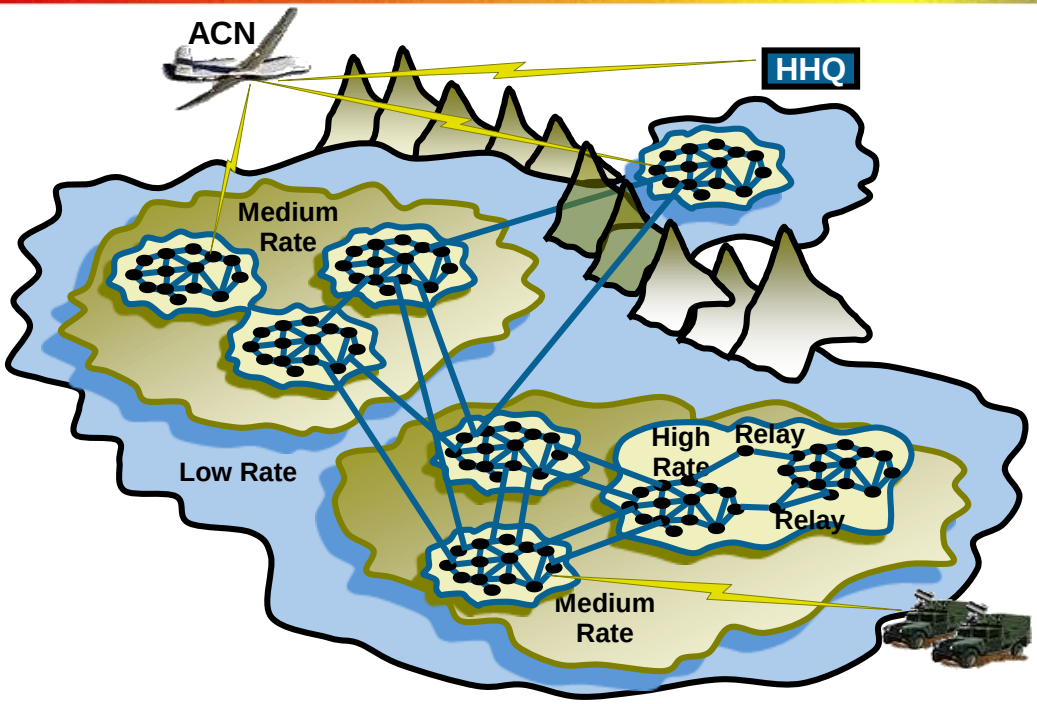
Networks continue to function through attacks by hackers, viruses, electronic jammers, or physical disruption

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- Detection, Precision ID, Tracking, and Destruction of Elusive Surface Targets
- Location and Characterization of Underground Structures
- Force Multipliers for Urban Area Operations
- Networked Manned & Unmanned Systems
- **Robust, Secure Self-Forming Tactical Networks**
- Cognitive Systems
- Assured Use of Space
- Bio Revolution

Robust, Secure Self-Forming Networks





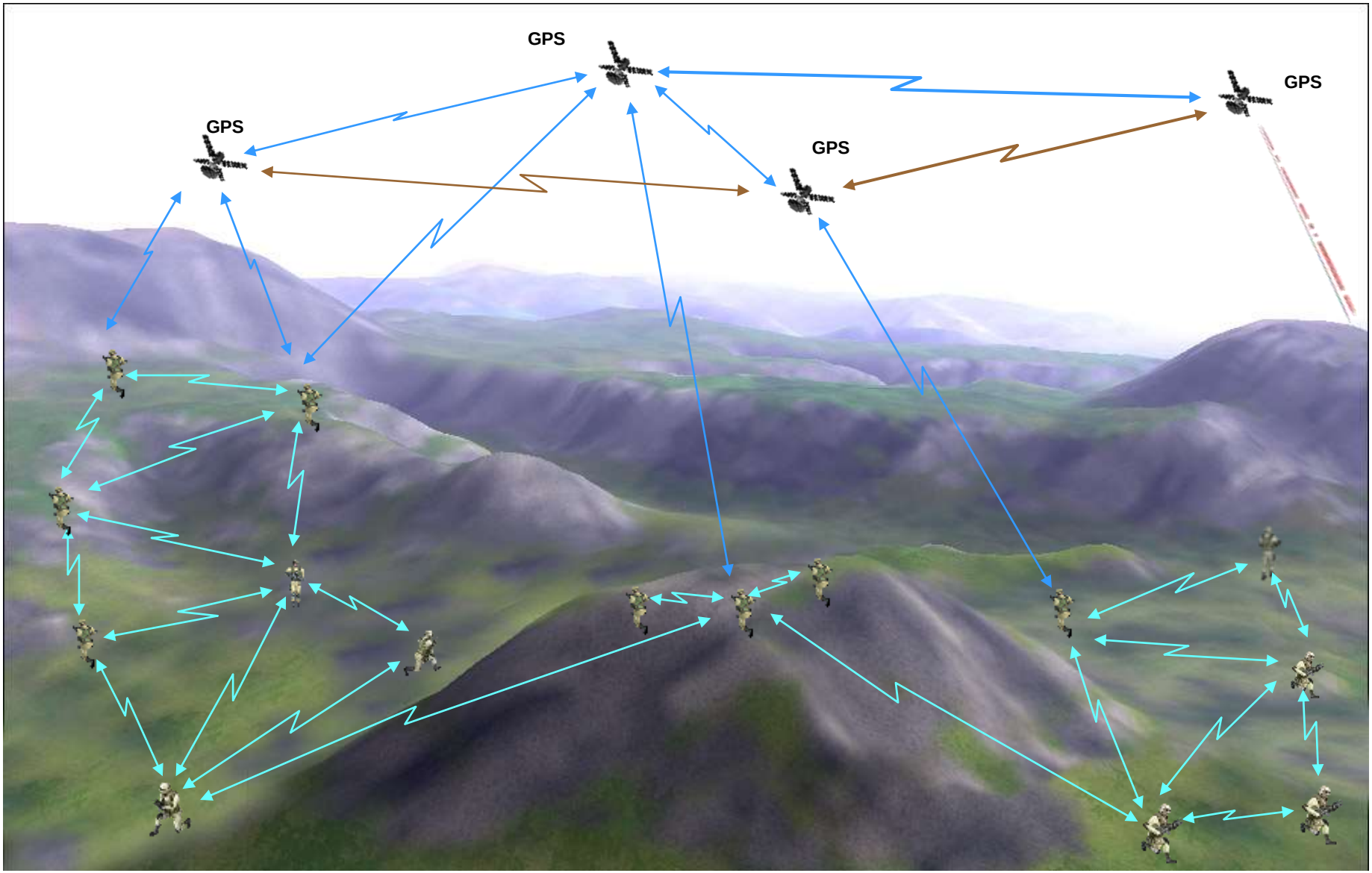
Unparalleled Communications

- Connectivity guaranteed in any environment, at distances and data rates never before available
- Minimum or no fixed infrastructure
- Ad hoc peer to peer networking

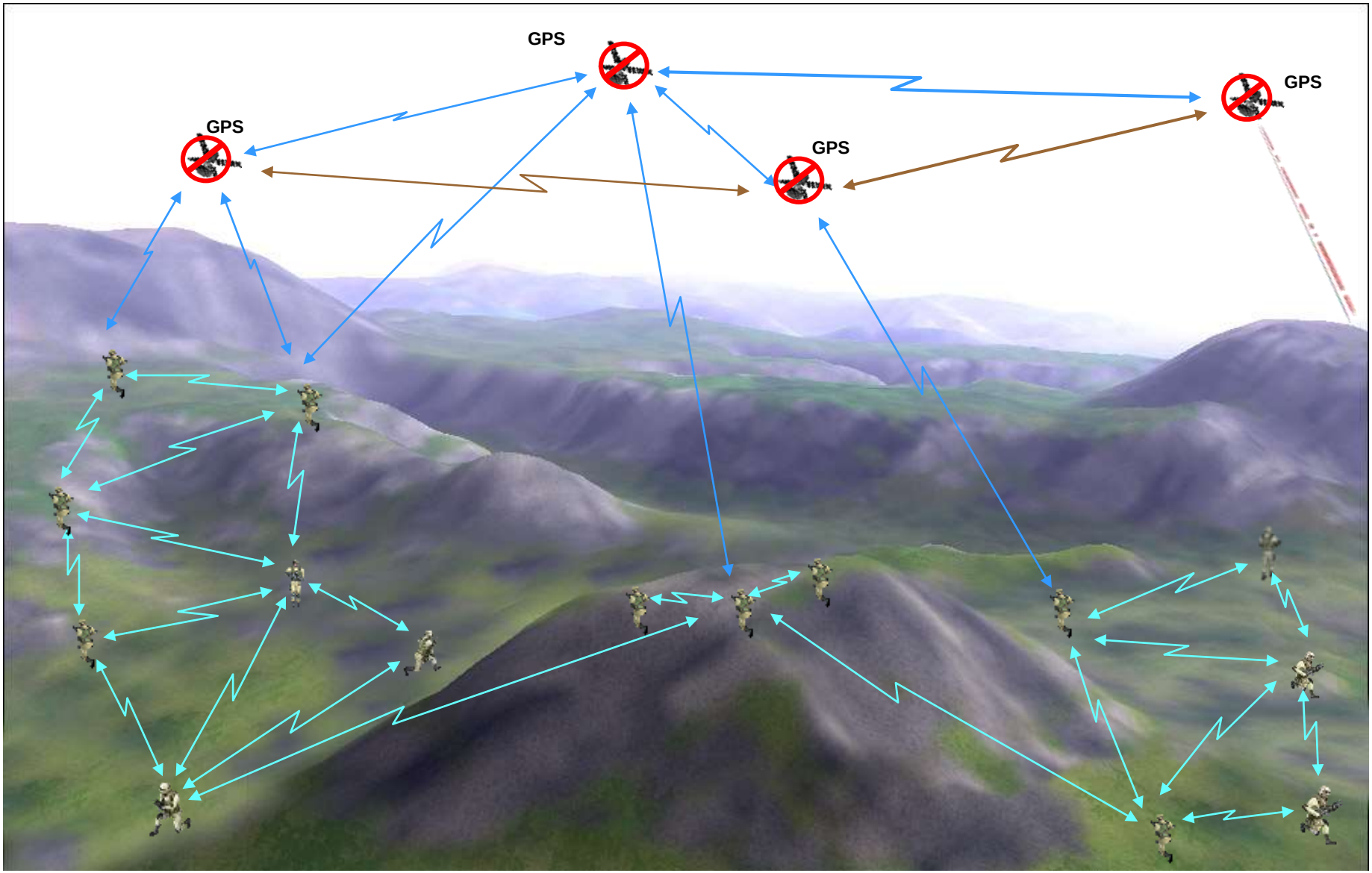
Assured Networking

- Building trustworthy systems from the ground up
- Networks to be intelligent, self-sensing & self-healing to detect and respond to attacks in real-time

Networks – GPS Reliance

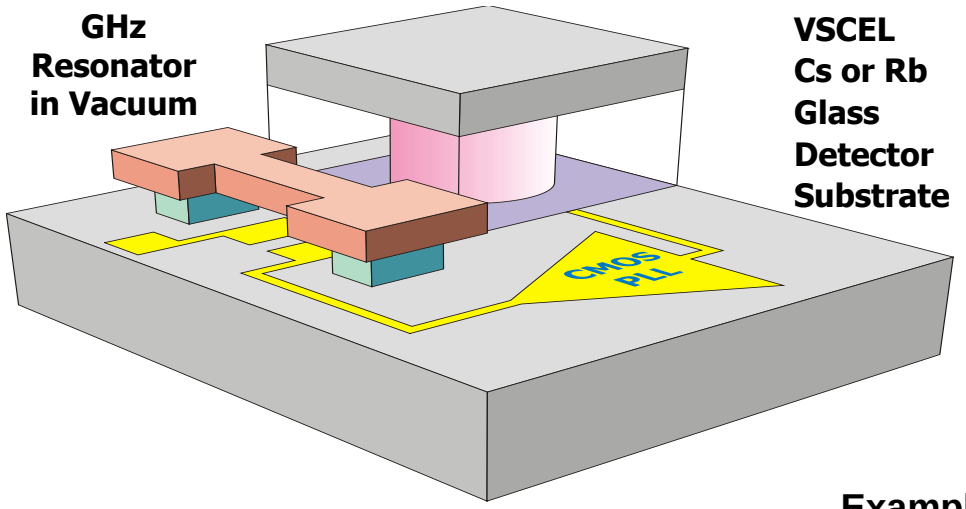


Self Forming Network – GPS



Chip-Scale Atomic Clock

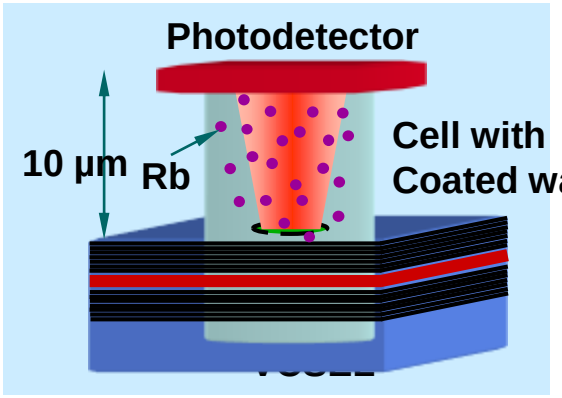
Ultra-miniaturized, low-power, atomic time and frequency reference units



>200X reduction in size

>300X reduction in power

($\pm 1 \times 10^{-11}$ accuracy $\Rightarrow$ <1μs/day)



Atomic Absorption Cell

Example of Use: **Radio System (SINCGARS)**

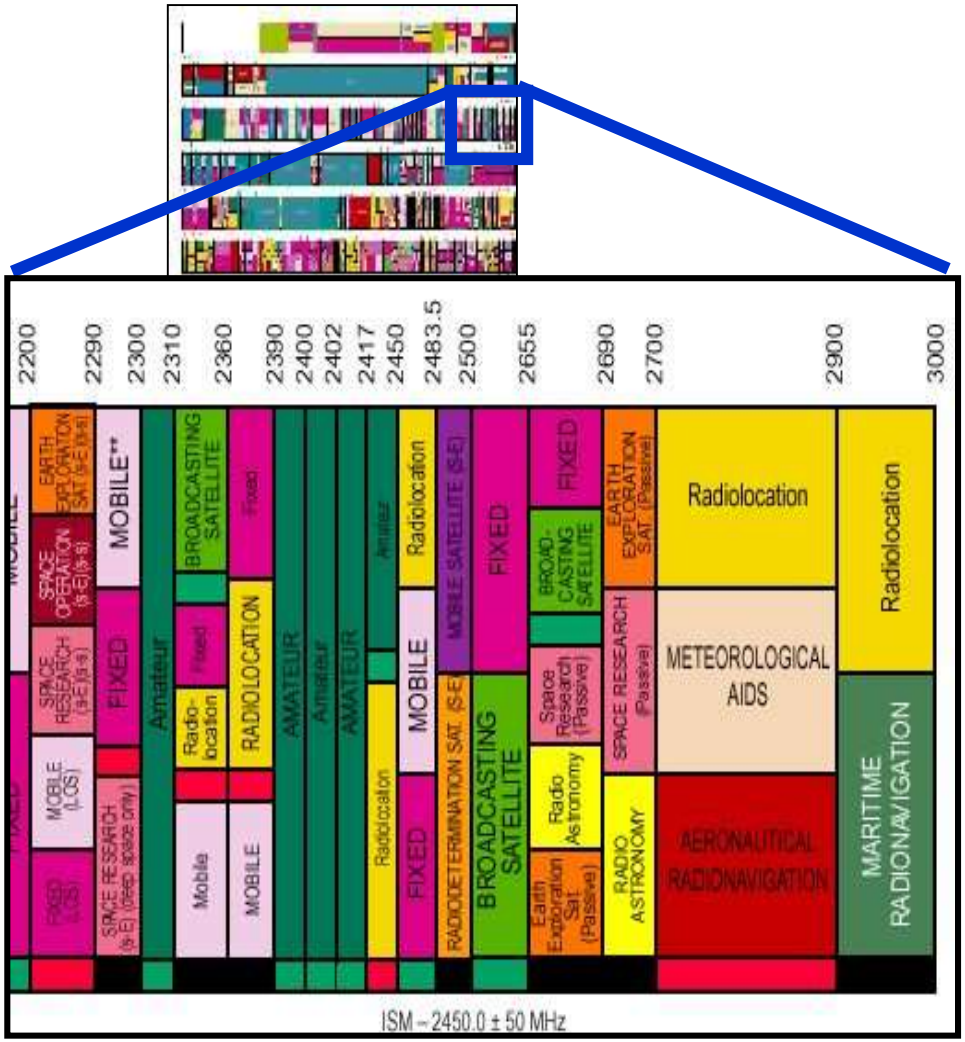




Clock accuracy of $1 \times 10^{-11} \Rightarrow$ 16-hour resynch interval or radio silence

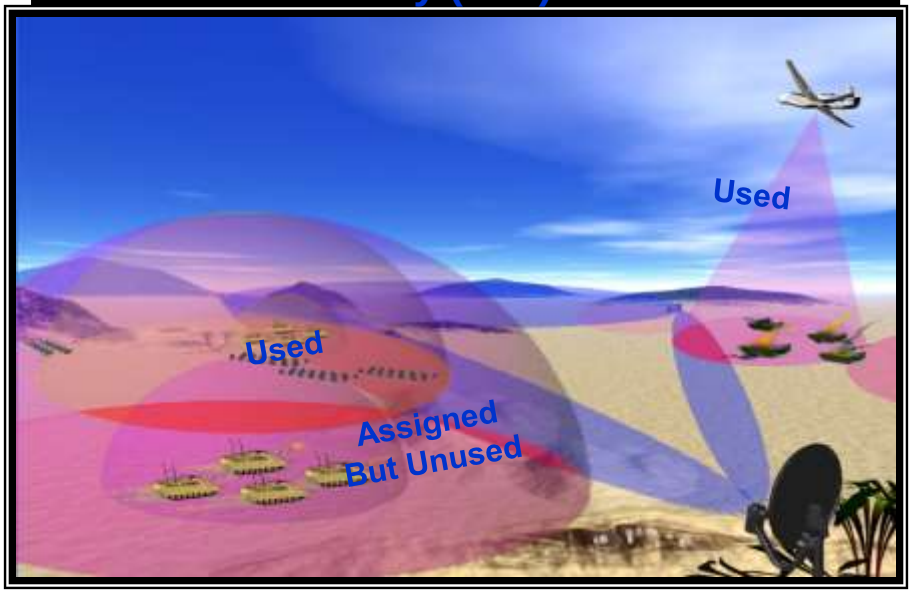
neXt Generation (XG) Communication

TODAY: **Spectrum statically allocated**



FUTURE : **Dynamically allocating spectrum in frequency, space, and time may improve utilization by a factor of 10**





Nanotechnology

Nano-Mechanical Array Signal Processing

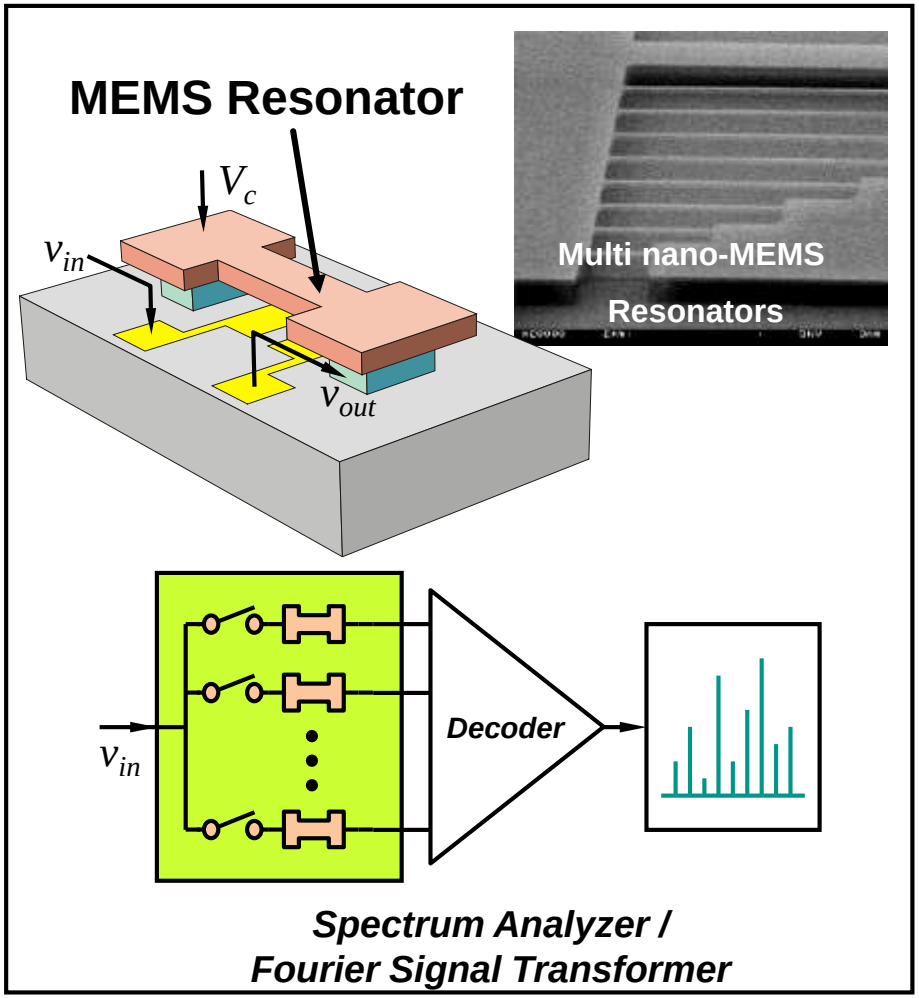
Create arrays of precision, nano MEMS structures for

RF-signal processing that achieve:

>100X reduction in size

>100X reduction in power consumption (300 mW to <3 mW)

>10X improvement in RF performance (spectral efficiency & bandwidth)

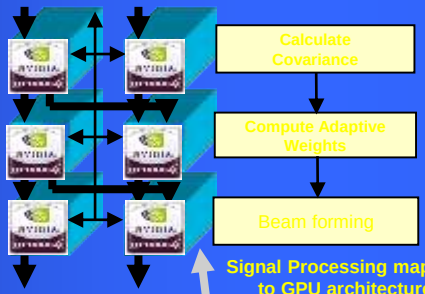


Microsystems Technology Office



3D Integrated Circuits

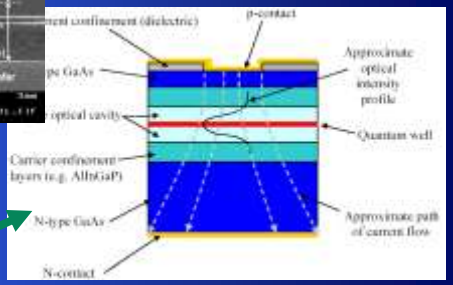
Vector Processor STAP (STAP-BOY)



Signal Processing mapped to GPU architecture



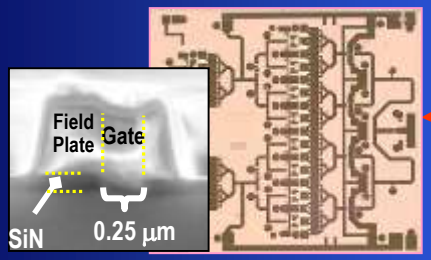
Vertically Integrated Sensor Array (VISA)



>70% Efficiency Laser Diode (SHEDS)



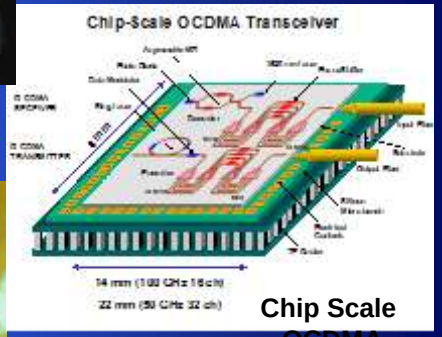
TFAST HBT cross-section



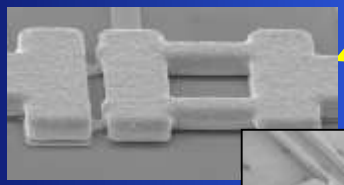
GaN High Frequency Transistor (WBG-RF)



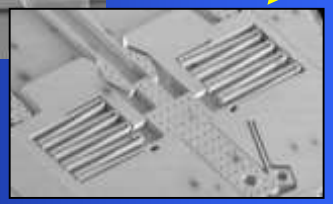
UV Laser and LED (SUVOS)



Chip Scale OCDMA



MEMS RF switch (RF MEMS Improvement RFMIP)



MEMS Safe-and-Arming Device (MEMS Exchange)



Photodiode



Cell



Optics



Laser



Chip Scale Atomic Clock

Algorithms

Architecture

Electronics

Photonics

MEMS/NEMS

DARPA's Strategic Thrusts

Investments Today for Future Capabilities

- Detection, Precision ID, Tracking, and Destruction of Elusive Surface Targets
- Location and Characterization of Underground Structures
- Force Multipliers for Urban Area Operations
- **Networked Manned & Unmanned Systems**
- Robust, Secure Self-Forming Tactical Networks
- Cognitive Systems
- Assured Use of Space
- Bio Revolution

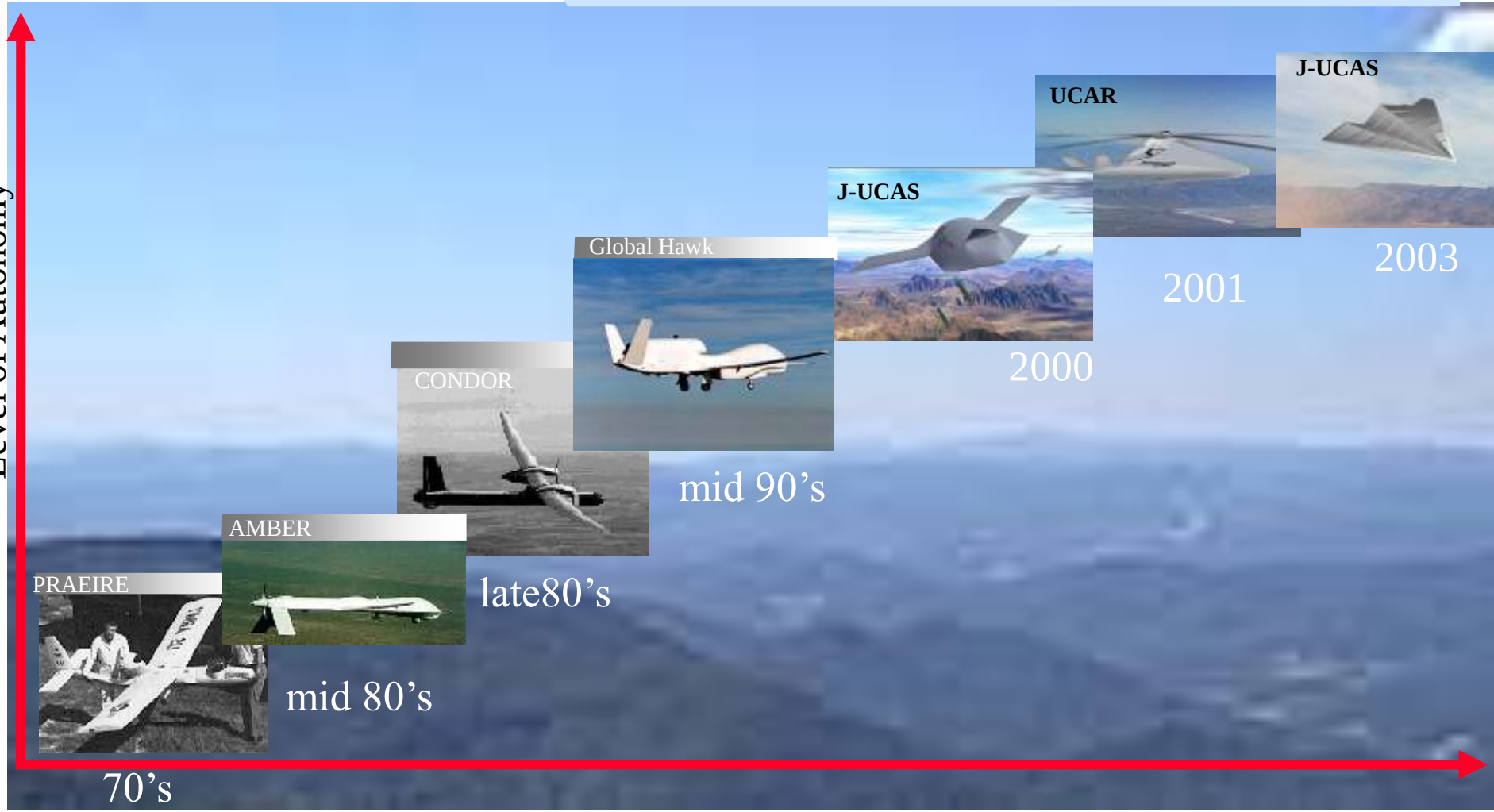
Unmanned Platforms

Past Successes Lead to Significantly More Complex Systems

EMPHASIS ON PERFORMANCE

EMPHASIS ON AFFORDABILITY

EMPHASIS ON MISSION EFFECTIVENESS & AFFORDABILITY

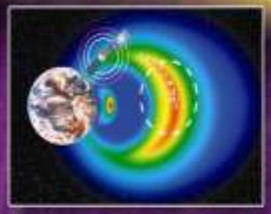


Tactical Technology Office

DARPA

TTO
Tactical Technology Office







Space Systems



Tactical Multipliers



Unmanned Systems



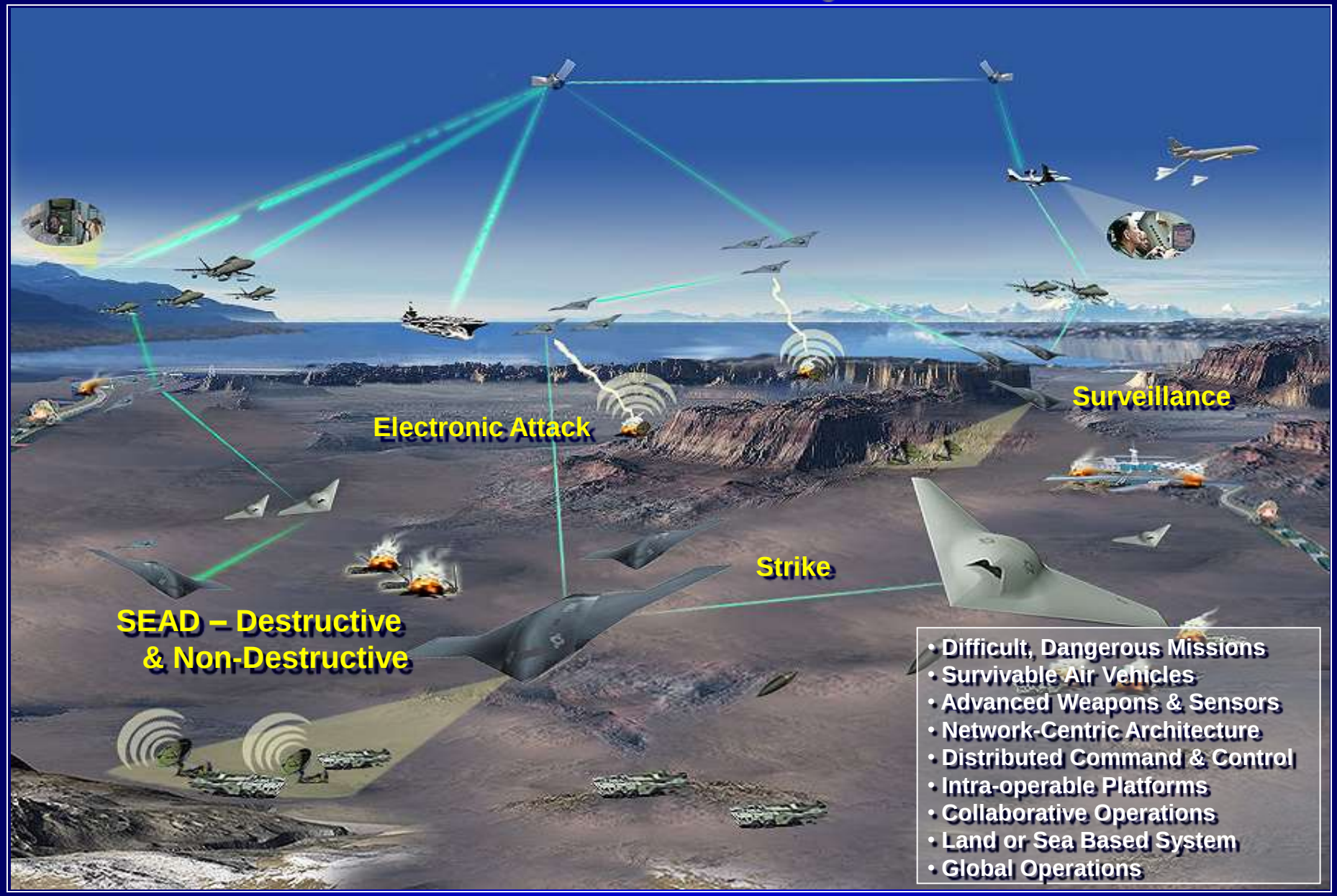






Approved for Public Release

Joint-Unmanned Combat Air Systems Office



DARPA Organization

Director, Tony Tether
Deputy Director, Bob Leheny

Information Exploitation
Ted Bially
Bob Tenney/Bob Popp

- **Sensors**
- **Exploitation Systems**
- **Command & Control**

Tactical Technology
Art Morrish
Gary Graham/Stephen Welby

- **Air/Space/Land Platforms**
- **Unmanned Systems**
- **Space Operations**
- **Laser Systems**
- **Future Combat Systems**
- **Planning / Logistics**

Special Projects
Amy Alving
Joe Guerci

- **Chem/Bio Def Systems**
- **Counter Underground Facilities**
- **Space Sensors/Structures**
- **Navigation/Sensors/ Signal Processing**

Advanced Technology
Dave Honey
Larry Stotts

- **Assured C3ISR**
- **Maritime**
- **Early Entry/Special Forces**

Joint Unmanned Combat Air Systems
Mike Francis

- **Common Systems & Technologies**
  - **X-45 System**
  - **X-47 System**

Defense Sciences
Steven Wax
Brett Giroir

- **Bio Warfare Defense Technologies**
- **Biology**
- **Materials & Devices**
- **Mathematics**

Information Processing Technology
Ron Brachman
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- **Cognitive Systems**
- **Computational - Perception**
- **Representation & Reasoning**
- **Learning**
- **Natural Communication**

MicrosystemsTechnology
John Zolper
Dean Collins

- **Electronics**
- **Optoelectronics**
- **MEMS**
- **Combined Microsystems**

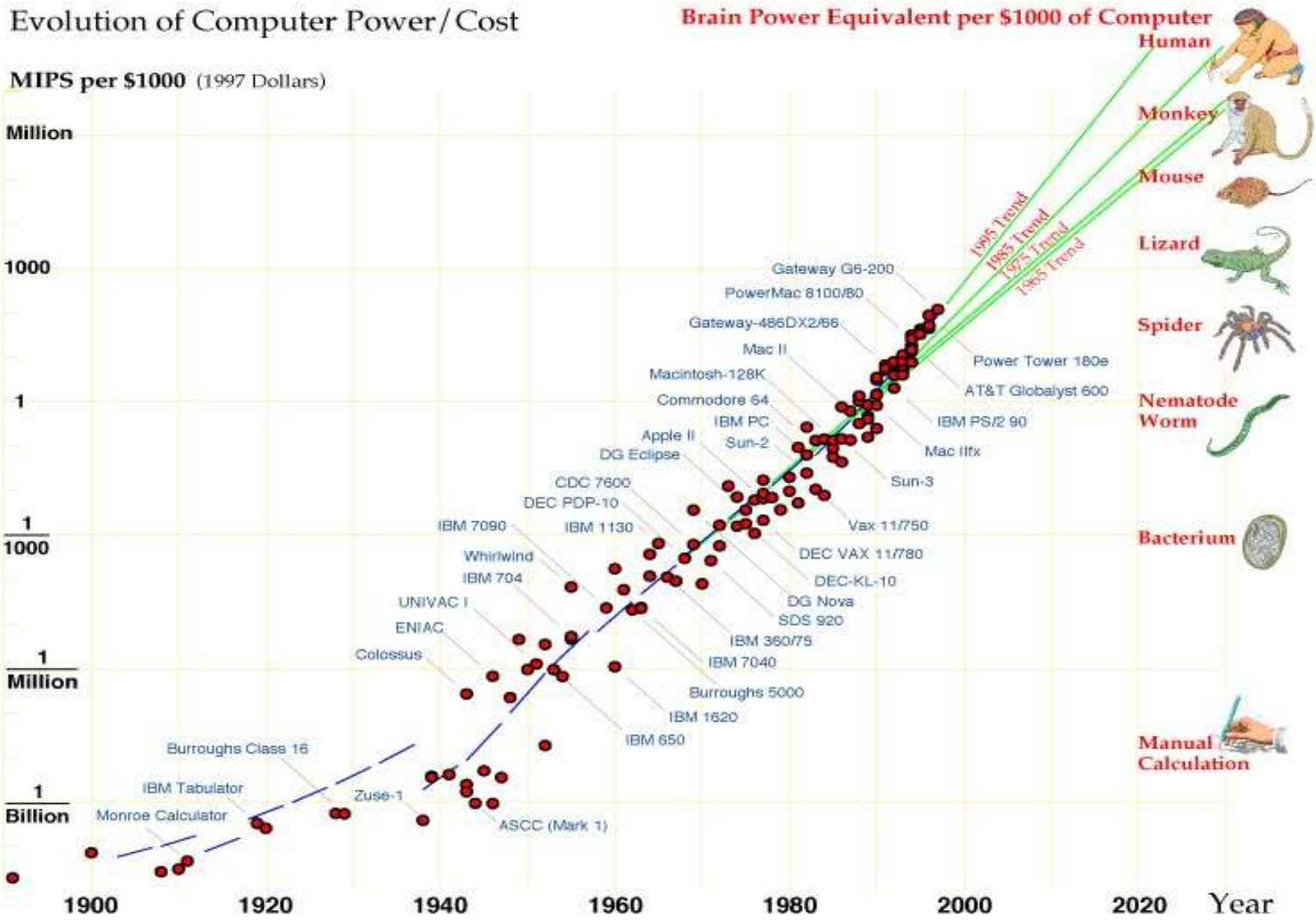
J-UCAS Transitioning to Air Force FY06

DARPA's Strategic Thrusts

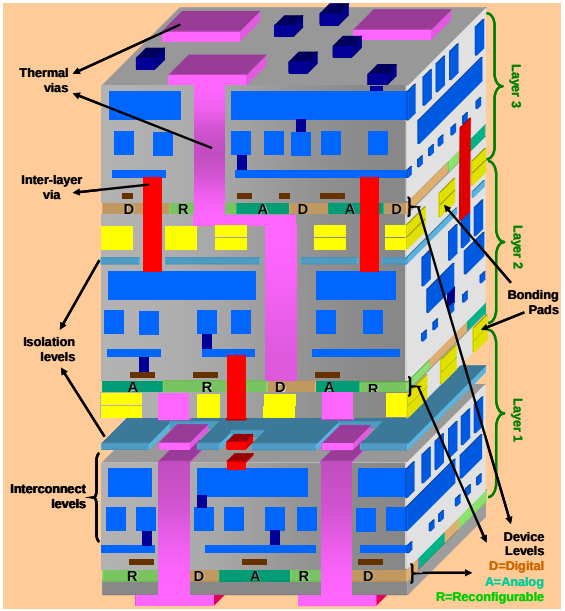
Investments Today for Future Capabilities

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- Robust, Secure Self-Forming Tactical Networks
- **Cognitive Systems**
- Assured Use of Space
- Bio Revolution

The Extension to Intelligent Systems



Design Tools for Integrated 3-Dimensional Electronic Circuits



DESCRIPTION / OBJECTIVES / METHODS

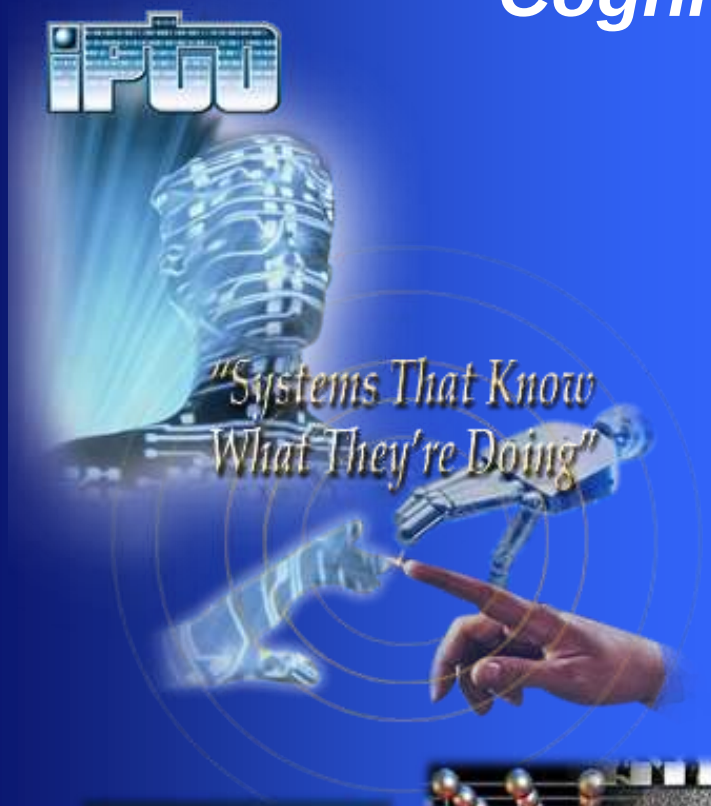
- 3-D integration significantly improves circuit performance by reducing interconnect lengths and critical delays as device sizes continue to shrink and integration densities and chip areas continue to increase.
- Novel 3D layout/routing tools, placement technologies and coupled thermal/electrical analysis tools to enable automated design of 3D circuits

MILITARY IMPACT / SPONSORSHIP

- 3D integration has the potential to produce high performance, military relevant digital and mixed signal circuits while optimizing noise, floor area, throughput and delay.
- AFRL, EDA Community, Collaboration with other DARPA programs (NeoCAD, IRFFE, TEAM and 3D-IC).

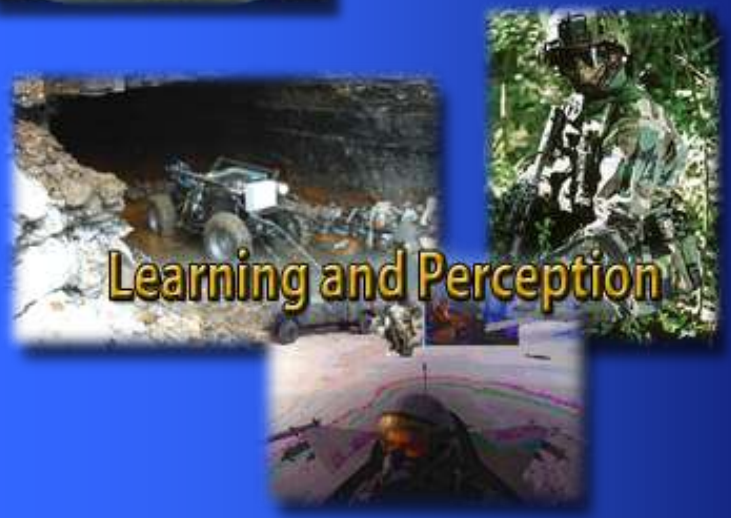
Information Processing Technology Office

Cognitive Systems









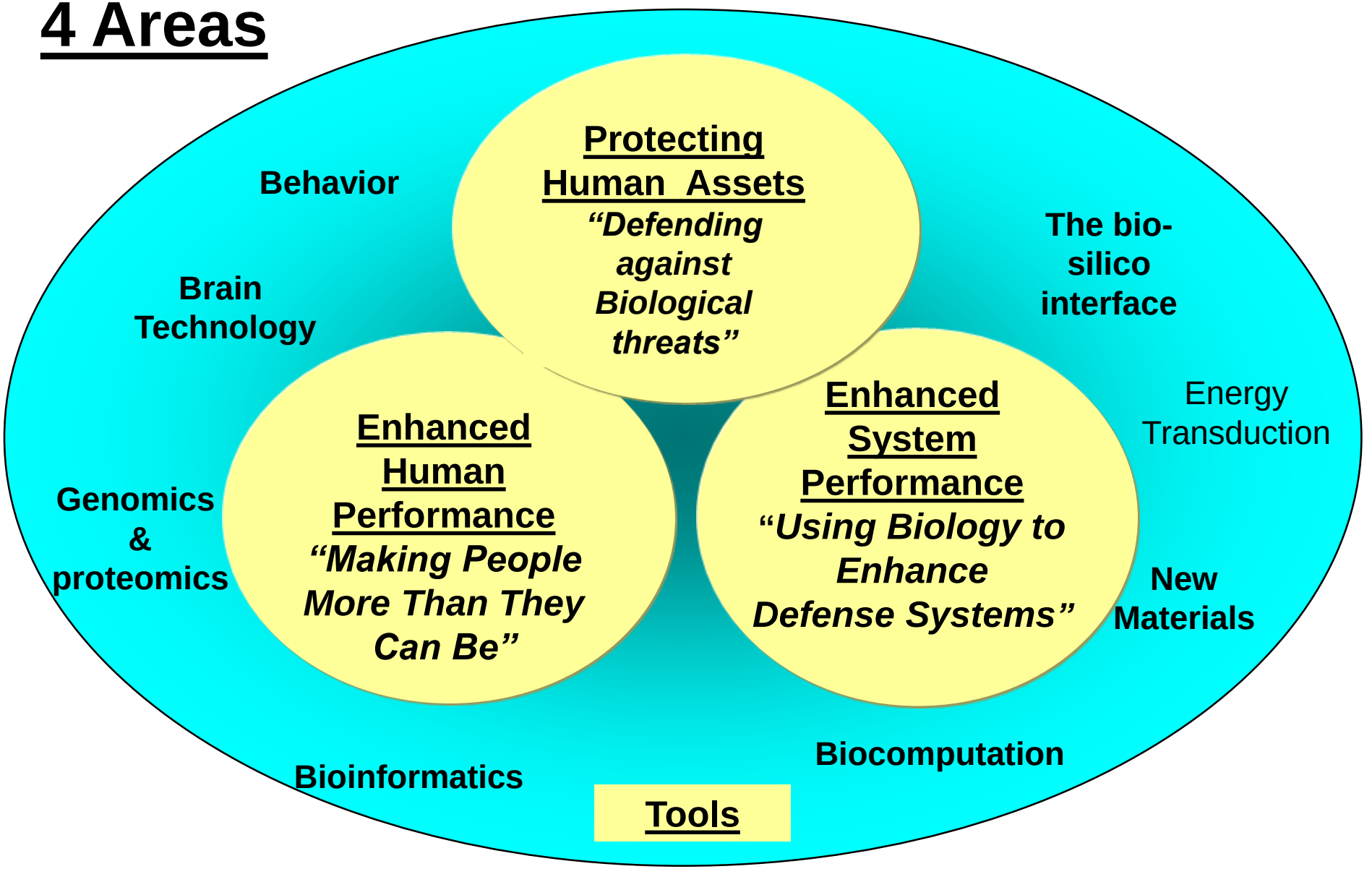
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- **Bio Revolution**

Bio Revolution

4 Areas

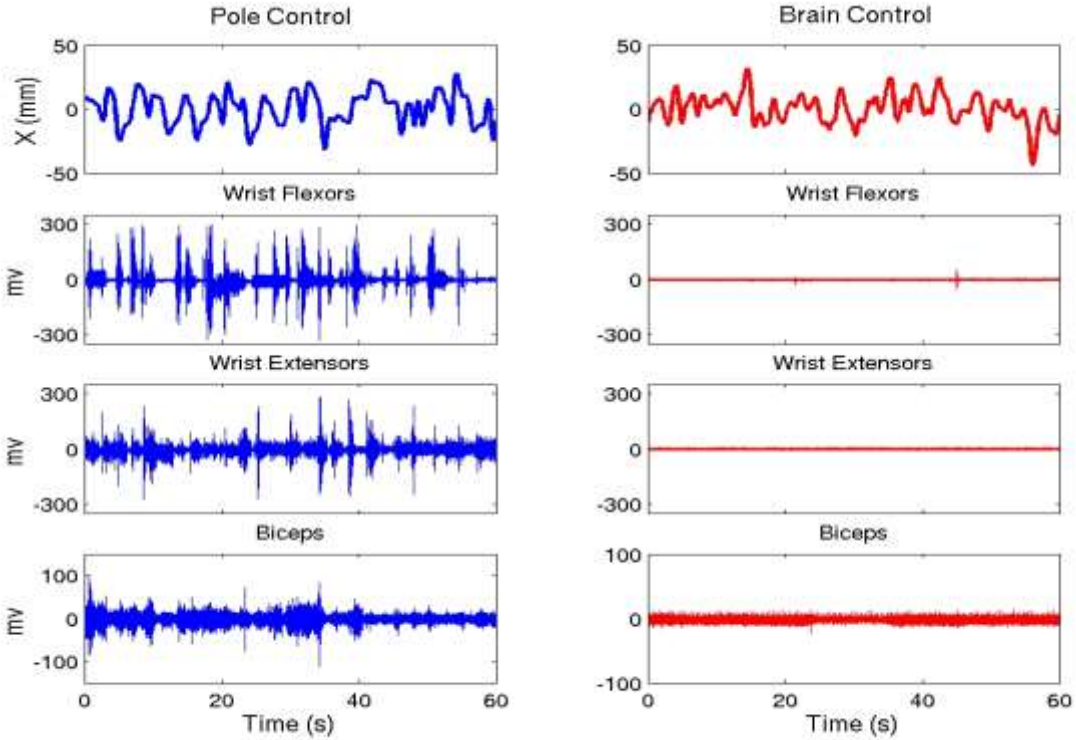


Human Assisted Neural Devices

Use brain activity to command, control, actuate and communicate with the world directly through brain integration with prosthetics and peripheral devices

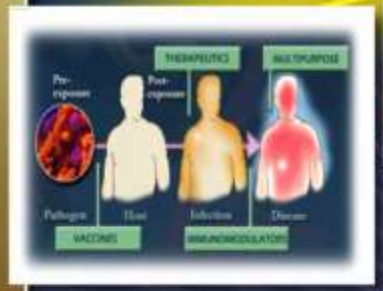


- Closed loop demonstration of arm reach and grasp of food
- Open loop demonstration of human control of gripping force
- Long-term compatibility
- Non-invasive correlates



Defense Science Office











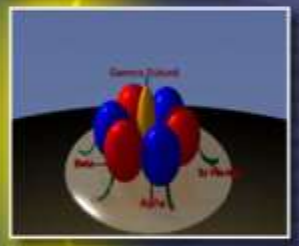




Biology

Materials & Devices

Mathematics





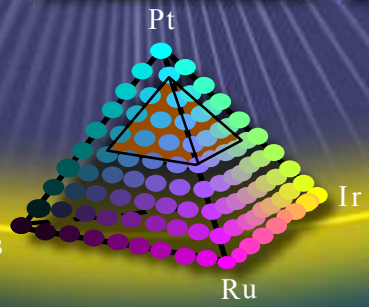


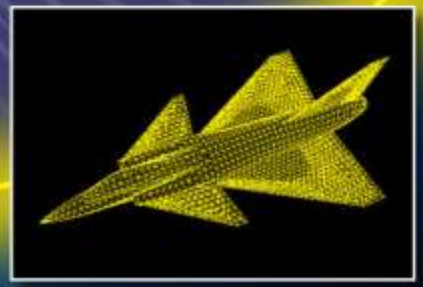












DARPA's Strategic Thrusts

Investments Today for Future Capabilities

- **Force Multipliers for Urban Area Operations**

Special Projects Office

Chem/Bio/Rad



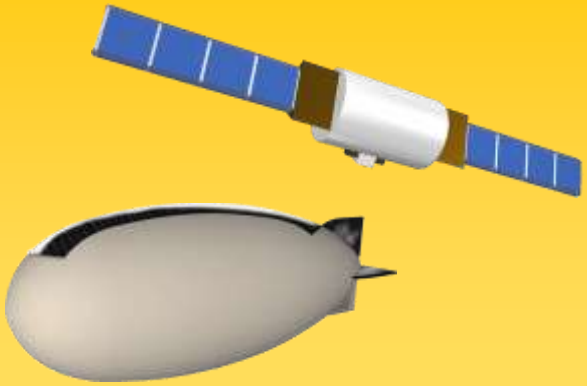
Counter Undergrounds



GPS-Free Navigation



Tailored Tactical Surveillance



Urban Operations



Virtual Space Office

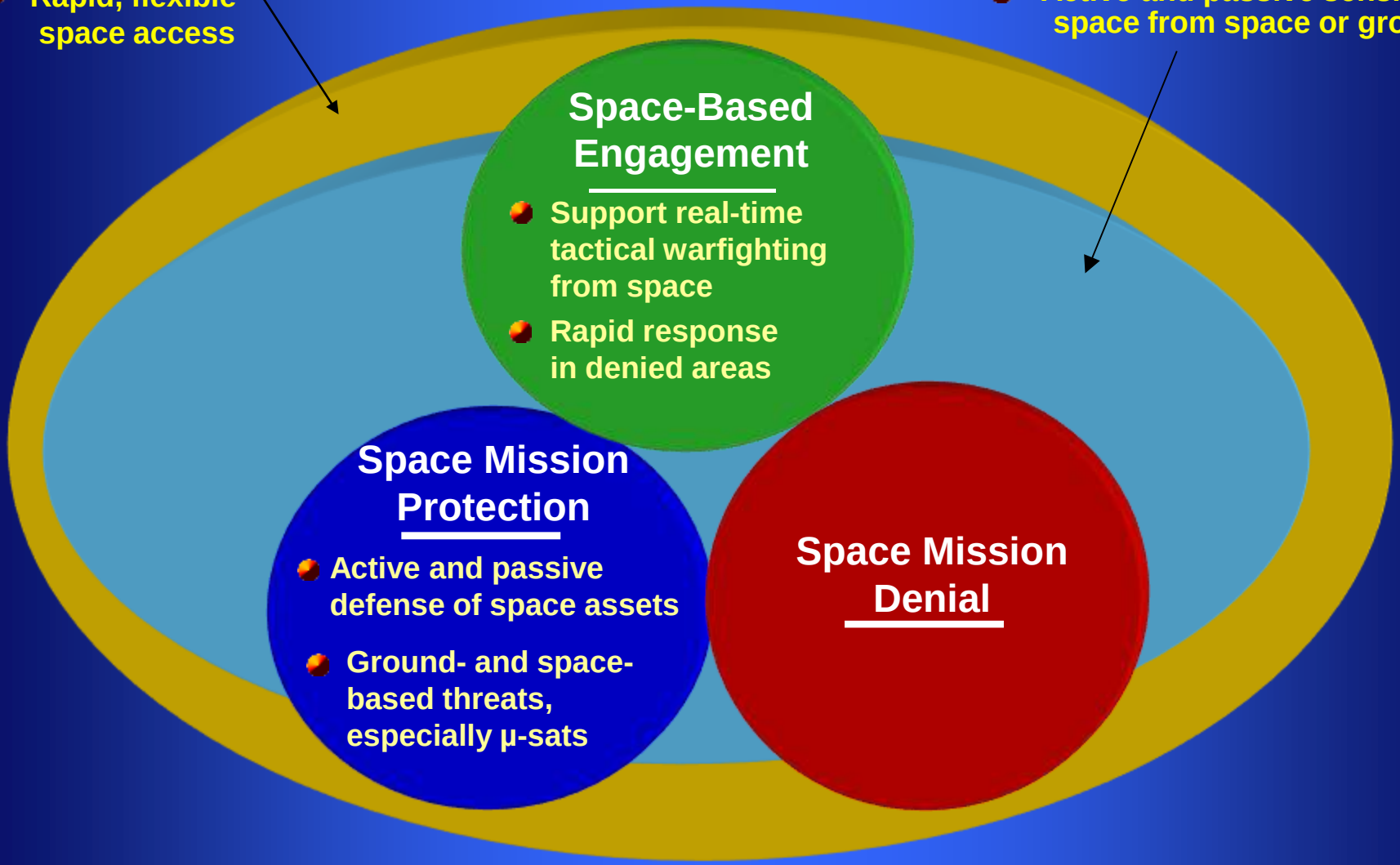
DARPA Space Projects – Five Areas

Access & Infrastructure

- Rapid, flexible space access

Situational Awareness of Space

- Active and passive sensing of space from space or ground



Upcoming Key DARPA Events

DARPATech 2005
24th DARPA Systems & Technology Symposium

August 9 –August 11, 2005

Anaheim, California



GRAND CHALLENGE

National Qualification Event
September 28 – October 5, 2005

Fontana Speedway

Grand Challenge Event
October 8, 2005

Southwestern United States





Getting Technology to the Warfighter

Bridging the Gap

From Research to Applications

Dr. Robert F. Leheny
Deputy Director



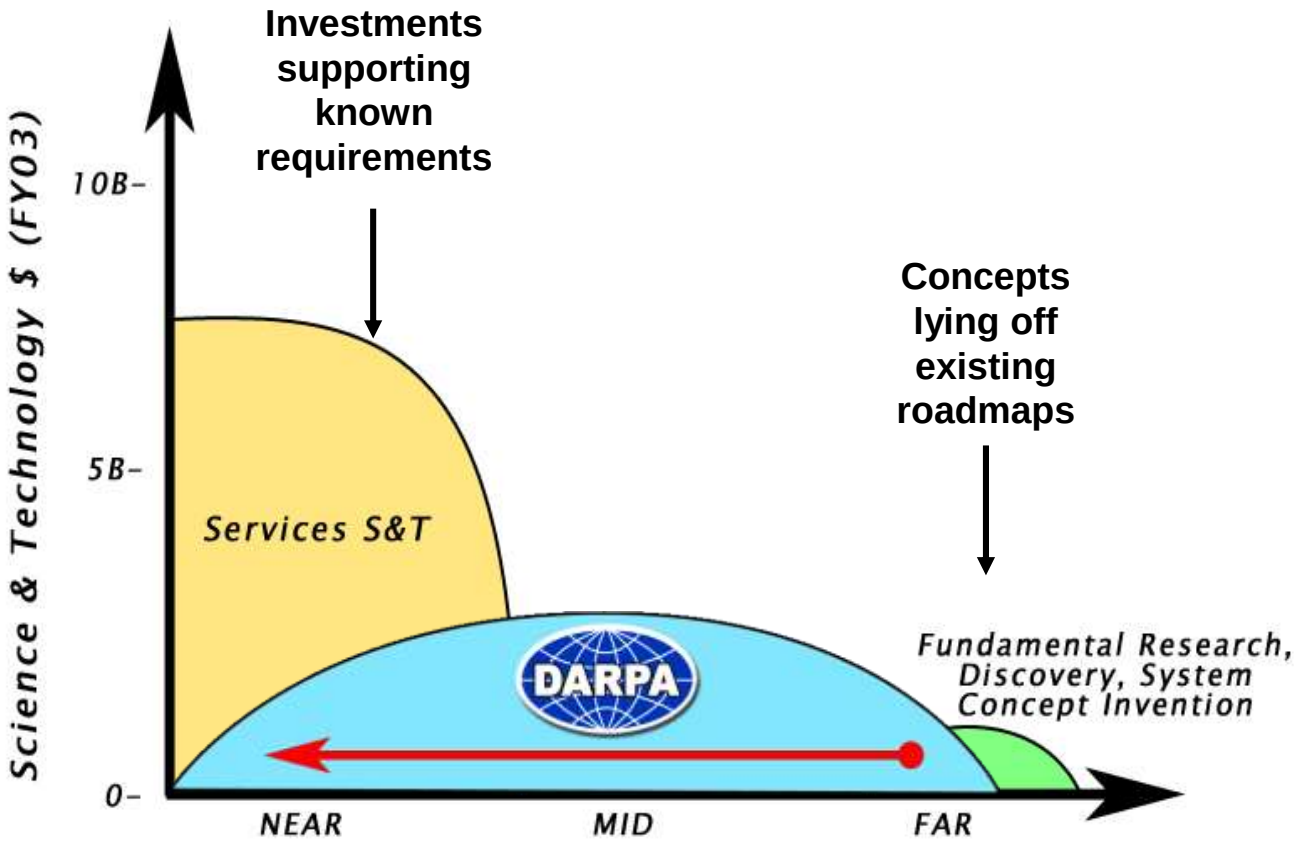
Getting Technology to the Warfighter

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Dr. Robert F. Leheny
Deputy Director

DARPA's Role in Defense Science & Technology



DARPA sponsoring revolutionary, high-payoff research that <u>bridges the gap</u> between fundamental discoveries and their military use

Maintaining the technological superiority of the U.S. military while preventing technological surprise from harming our national security

DARPA's New Initiative Process

DIRO, Program Mgr, Office, Director, Comptroller

Step III
- Program Reviews
- "Go / No Go" Evaluations

Contract

Step II
- Select Performers

BAA & SS

Step I
- Define "Go / No Go" Criteria
- Permission to Issue BAA

Step 0 Initial Study



Program Manager



Office Director



"Far-Side"
Industry
Universities
Government

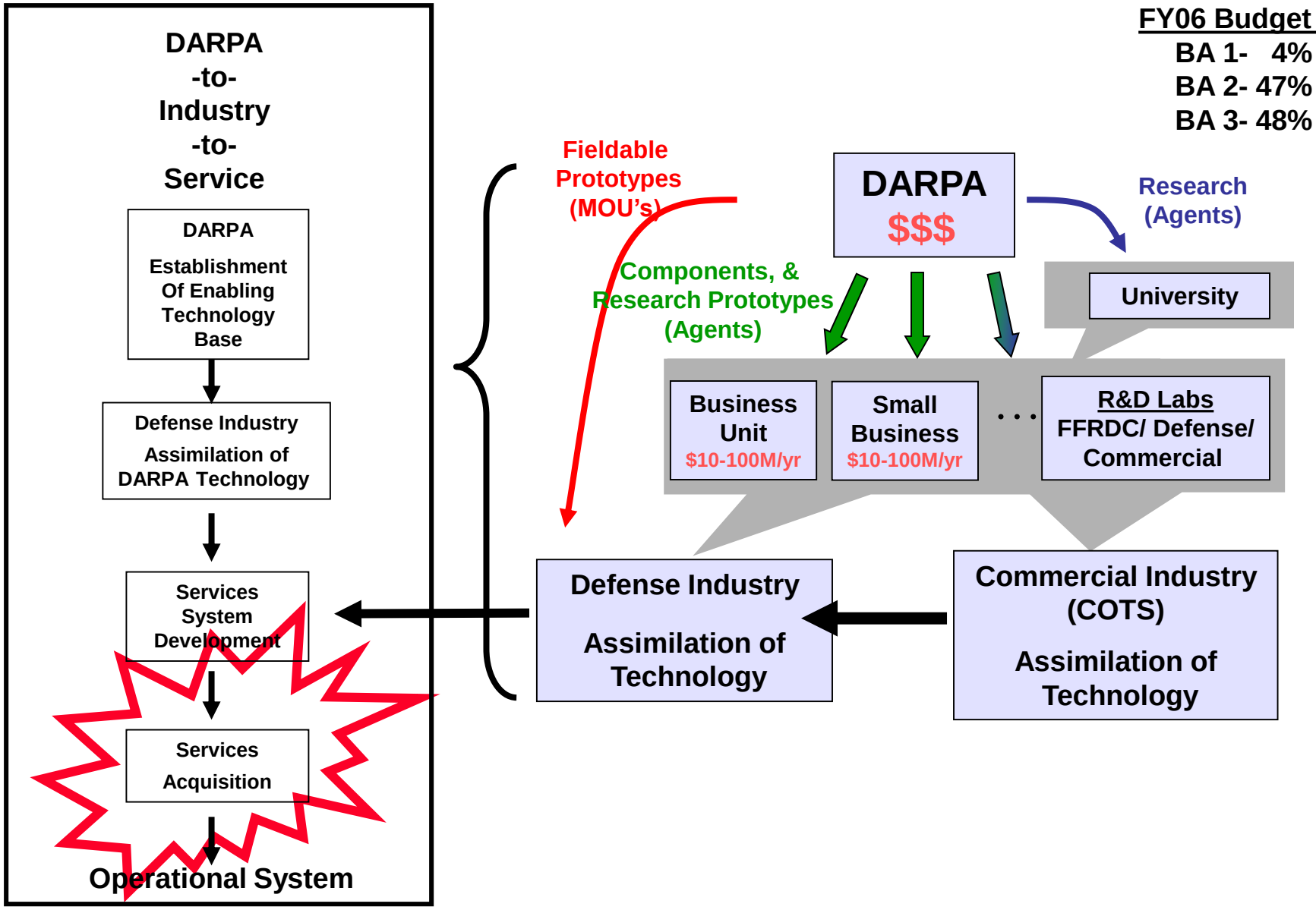
DARPA

- **Majority of PM's are not career government- industry / academic**
  - **Typical term at DARPA- 4-5 yrs; constant flow of new ideas**

- **>80% DARPA contracting done by other Organizations for DARPA**
  - **COTR provides corporate memory**
  - **Where appropriate Service Labs engage in test/ evaluation of contractor deliverables**

- **DARPA Challenge**
  - ***Industry* to service to procurement**

DARPA Technology Transition Strategy



DARPA's Strategic Thrusts

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- Cognitive Systems
- Assured Use of Space
- Bio Revolution
- Underlying Technologies

DARPA Organization

Director, Tony Tether
Deputy Director, Bob Leheny

Information Exploitation
Ted Bially
Bob Tenney/Bob Popp

- **Sensors**
- **Exploitation Systems**
- **Command & Control**

Tactical Technology
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- **Maritime**
- **Early Entry/Special Forces**

Joint Unmanned Combat Air Systems
Mike Francis

- **Common Systems & Technologies**
  - **X-45 System**
  - **X-47 System**

Defense Sciences
Steven Wax
Brett Giroir

- **Bio Warfare Defense Technologies**
- **Biology**
- **Materials & Devices**
- **Mathematics**

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Ron Brachman
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- **Representation & Reasoning**
- **Learning**
- **Natural Communication**

MicrosystemsTechnology
John Zolper
Dean Collins

- **Electronics**
- **Optoelectronics**
- **MEMS**
- **Combined Microsystems**

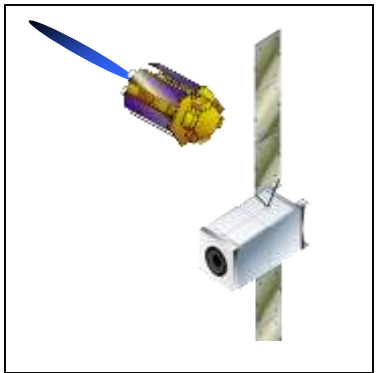
Opportunity

- **DARPA Always Interested in Good Ideas**
  - **Consult DARPA Strategic Plan**
  - **Talk to DARPA Program Managers**

    (www.darpa.mil)
  - **or Join DARPA as a Program Manager!**









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Anaheim, California



GRAND CHALLENGE

National Qualification Event
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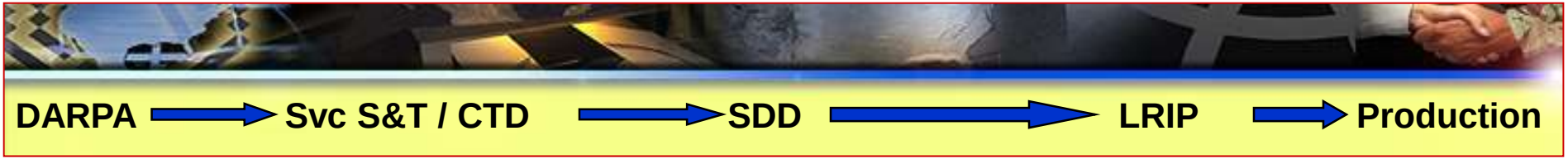


DARPA to Service Transition Acquisition Paths

DARPA



Components, small systems



Concept and Technology Development (MS A)

System Development and Demonstration (MS B)

Low Rate of Initial Production (MS C)

Prototypes



POM submit

Department of Homeland Security Science & Technology Directorate Border and Transportation Security Portfolio

Ms. Jeanne Lin

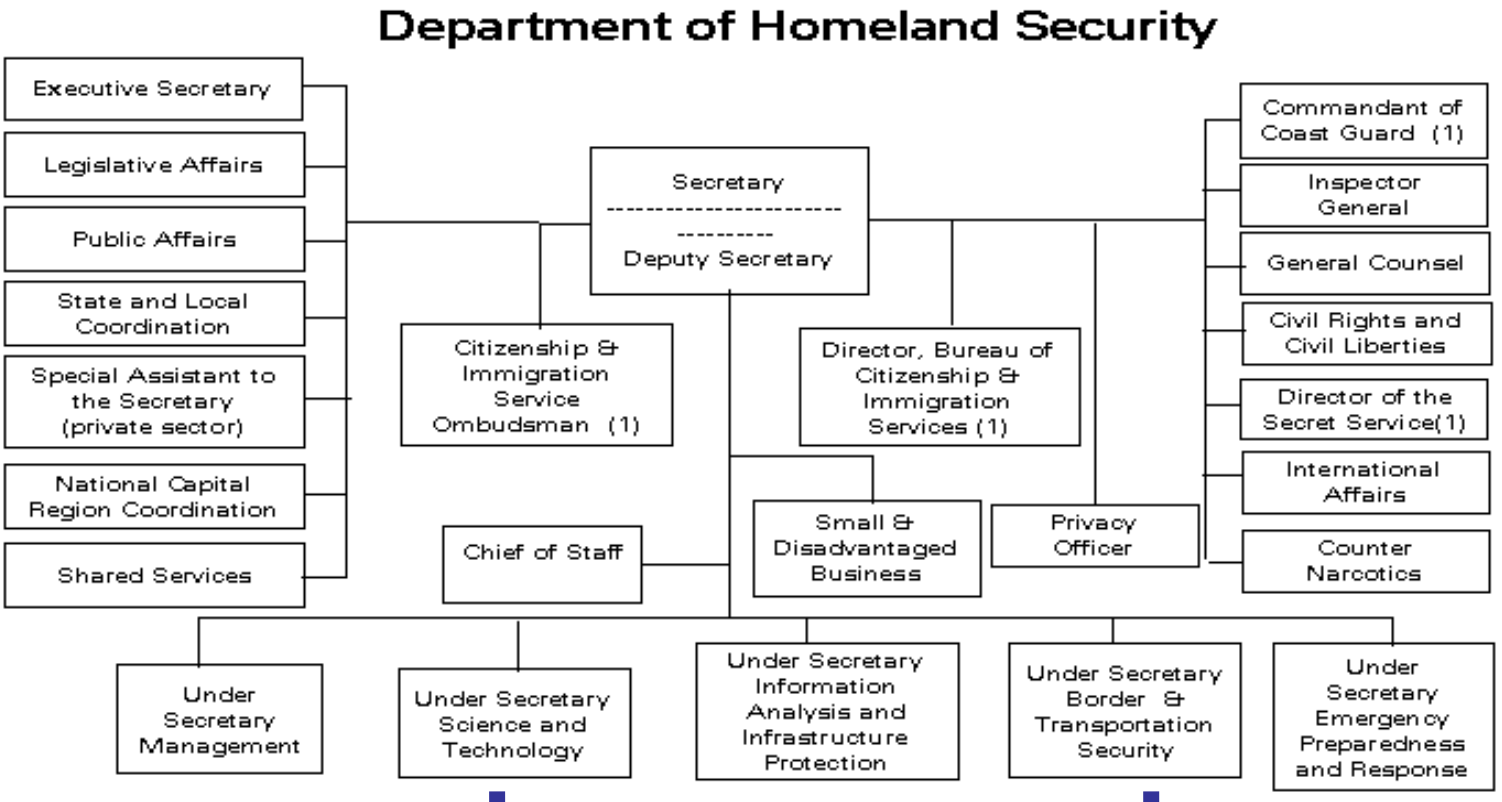
Director, BTS Portfolio

April 20, 2005

Homeland Security

Agenda

- S&T Organizational Background
- Border and Transportation Security (BTS) Mission and Objectives
- BTS Portfolio Strategic Technology Planning
- BTS Portfolio Program examples
- Observations of a DHS “Plank Owner”



Science and Technology – Border & Transportation Security

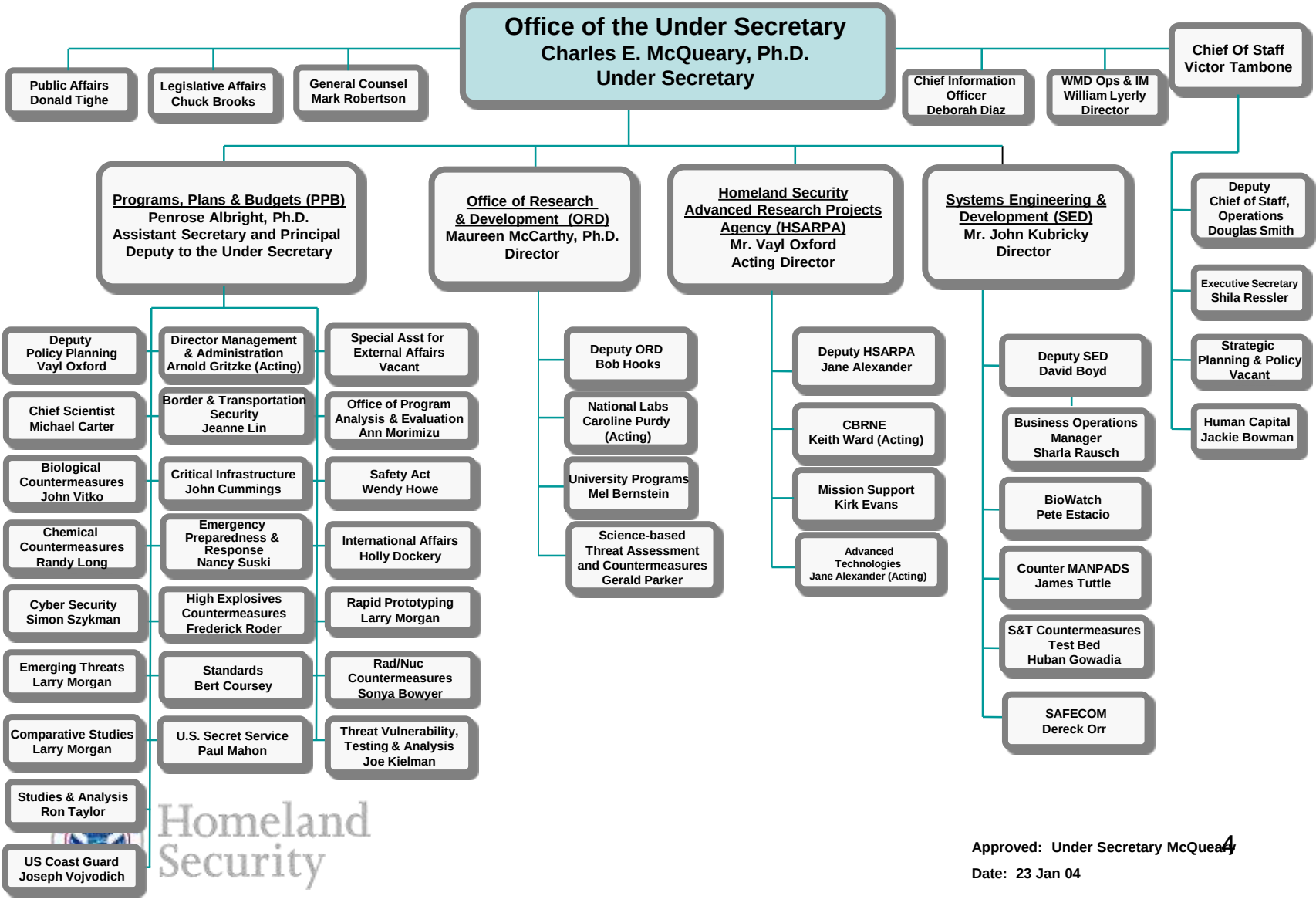
Homeland Security

- U.S. Customs and Border Protection
- U.S. Immigration and Customs Enforcement
- Transportation Security Administration
- Federal Law Enforcement Training Center

Department of Homeland Security

Revised: 23 January 2004

Science and Technology Directorate



Approved: Under Secretary McQueary

Date: 23 Jan 04

BTS Integrated Product Team Mission

Mission Statement

Develop and Transition Capabilities that Improve the Security of our Nation's Borders and Transportation Systems without Impeding the Flow of Commerce and Travelers

Homeland Security

BTS Objectives

Strategic Objectives

- Prevent entry of terrorists, criminals and illegal aliens
- Interdict terrorist instruments and contraband at the earliest opportunity
- Improve the security of U.S. transportation systems
- Facilitate flow of commerce and travelers – identify, disrupt & dismantle entities that threaten the United States

Homeland Security

BTS Challenges

Addressing Risk

The new security environment requires us to secure our border and transportation infrastructure, not just stem the tide of illegal activities. That is a far more difficult goal and there will never be enough officers to cover the vast areas that must be secured.

Threat Examples

Terrorists
Instruments of Terror
Explosives
Smugglers
Vehicles/Vessels as Vectors

Vulnerability Examples

Unmonitored open border regions
Unmonitored inter-modal shipping containers
Interruption of Commerce Flow
Transportation Security
…*size and scope of problem*

Homeland Security

BTS Challenges (cont'd)

Addressing Risk

We must find ways to more effectively detect and react to threats to our border and transportation systems officers while facilitating the flow of people and goods

The S&T/BTS technology investments are aimed at that goal

Homeland Security

BTS Portfolio Strategy

BTS Portfolio must be a Systems Integrator

- Conduit for Technology Portfolios
- Conduct Studies and Analysis where needed
- Utilize capabilities where existing or planned
- Insert Technology into existing BTS programs (i.e. container security)
- Create new capability if called for (e.g. FAMs)
- Work with Customers in a collaborative and cooperative environment
- Involve Industry, Government, Academia
- Develop a Systems model for overall view

Homeland Security

BTS Inputs and Sources

Addressing Capability Gaps and Prioritization

- Public Law, Policy Guidance

- BTS Portfolio Strategic Technology Planning Process
  - Bottom-up (operator) input; Top-down (management) validation
  - Technology Workshops (capability gaps only)
  - Gaming scenarios

BTS Inputs and Sources (cont'd)

Addressing Capability Gaps and Prioritization

- Customer input and collaboration
  - Examples: Container Security, Federal Air Marshals, America's Shield Initiative, Arizona Border Control Initiative

- S&T Requirements Council; BTS Directorate Input; Risk Assessments

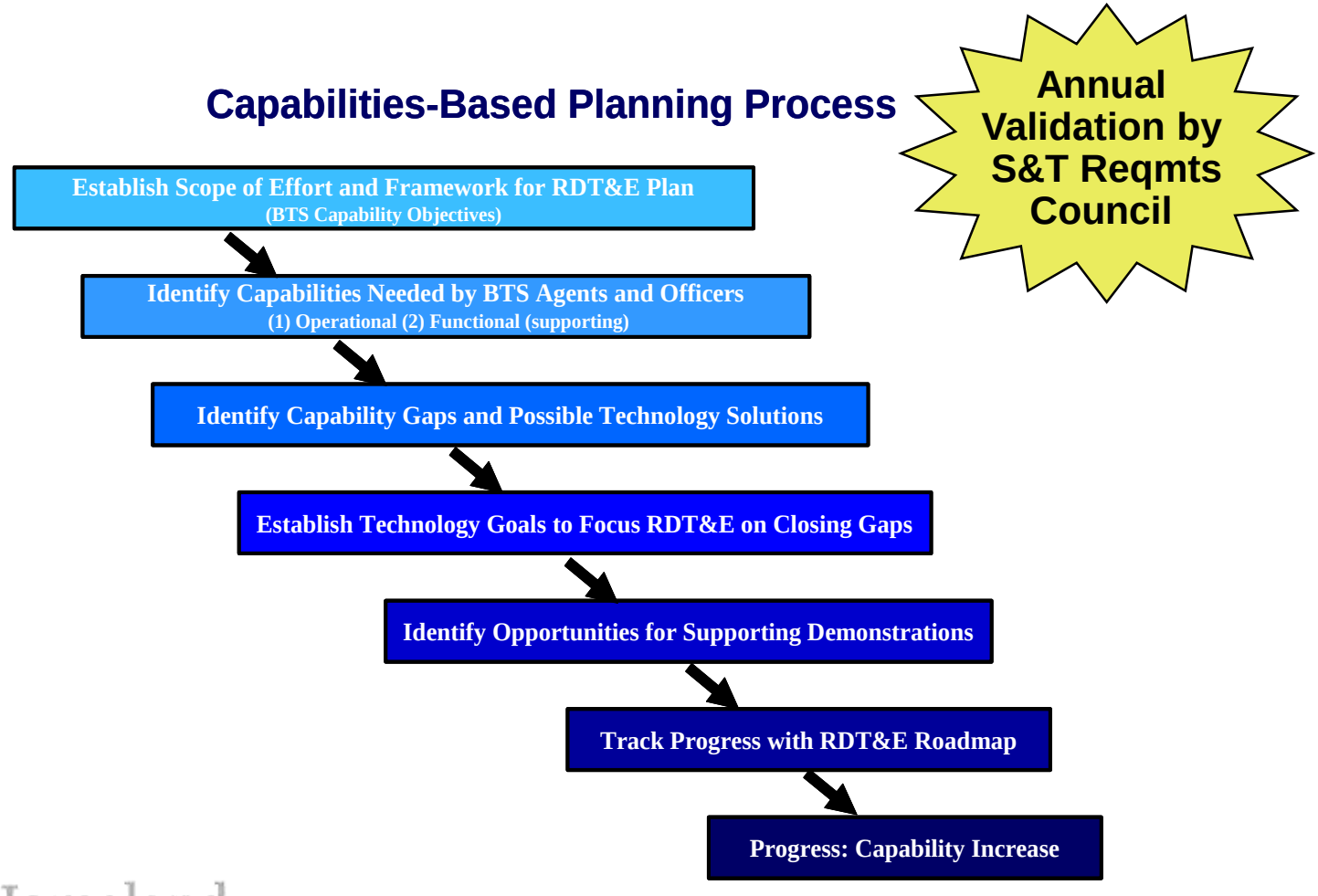
BTS/S&T Technology Priorities

How do we know S&T is working on highest priority BTS technology needs?

- **We are told it's a high priority**
- **We implement a capabilities-based technology planning process**
  - **A methodical process that involves Users, Technologists and Senior Management**

Homeland Security

Capabilities-Based Approach



Homeland Security

Border and Transportation Security
Operator Point-of-View

What Capabilities do We want?

And in what Type of Operating Conditions?

What Kind of Technology can be applied to address the Capabilities?

How do we use the Technology and how does it mesh into the Field?

What Areas does S&T Invest In?

What is the DHS BTS Technology Vision?

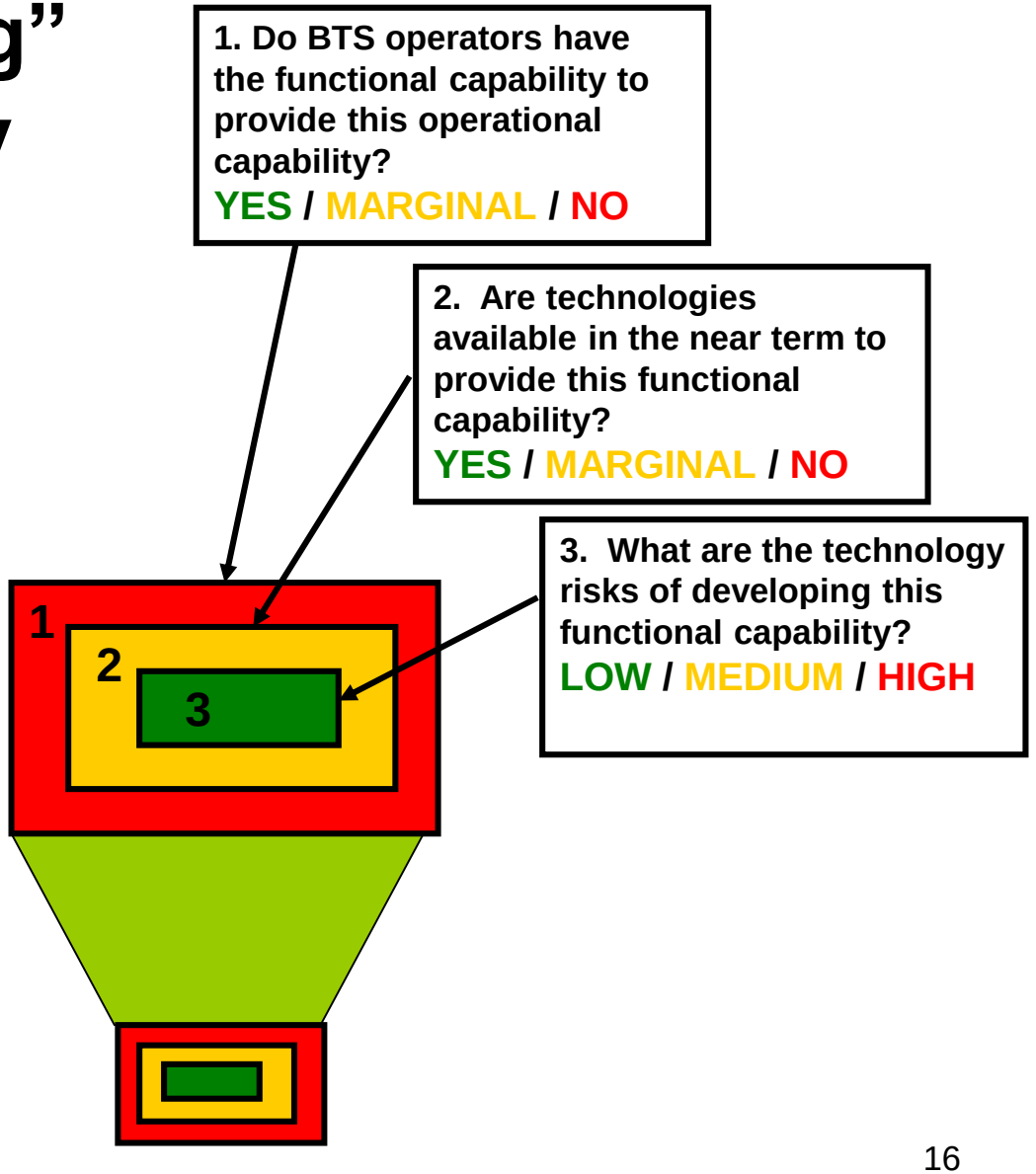
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BTS Capability Objectives

- Surveillance and Monitoring
- Communications and Information Management
- Targeting and Intelligence
- Officer Safety
- Apprehension/ Detention/ Seizure/ Removal
- Identification and Assessment
- Training and Proficiency
- Deterrence

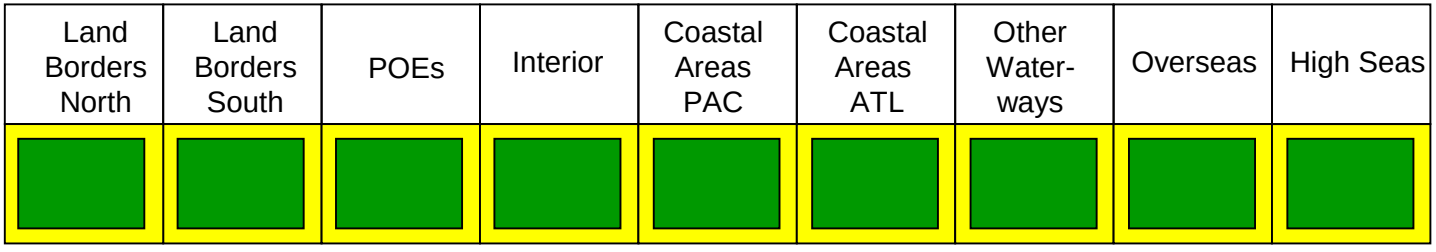
Homeland Security

"Color-coding" the Capability Objectives



Homeland Security

I&A2. Document Verification & Validity



Definition: The capability to examine, assess and determine document authenticity through existing and future data and physical systems.

Existing Programs

- Hand-held confirmed laminate viewers
- Diffraction grids for scrambled indicia
- Photo phones
- Secret Service anti-counterfeiting
- Embedded security strips

Technology Limitations and Barriers

Training and cost (training intensive)

BTS Portfolio

Developing Programs

- BTS Strategic Technology Planning Process
  - Operator Workshops
  - Scenario-based Seminar Gaming
  - Operator Integrated Product Teams
- Intelligence Community input
  - Scenario-based assessments
- BTS Directorate

Homeland Security

Portfolio Program Examples

Border and Transportation Security

- Border Watch
  - Border Detection Grid
- Container Security Program

Homeland Security

Border Detection Grid

Detect Persons and Contraband at Borders and POE's

- Current Capability
  - Some radar, seismic and video camera capabilities
  - Prototype fiber optic fence systems
  - America's Shield Initiative
  - UAV programs
- Interim Capabilities
  - Develop and prototype next generation of fixed sensors for southern borders
  - Integrate in a tech prototype in Southwest Border
  - First level sensor fusion capabilities
  - First level auto alert and scene understanding
  - Initial air mobile sensors prototypes
- Desired Capability End-State
  - Border with depth across US with high probability of detection (Pd) and low probability of false alarm (Pfa), accurate track and low latency
  - Automated alerting functions
  - Northern border extensions (different sensors)
  - Integration with NORTHCOM and AMOC
  - Integrated UAV, ground, aircraft real-time sensor fusion system
    - Across CBP, USCG, & ICE
    - LINK-16 – like
- Residual Risk
  - Integration into ASI
- Programs
  - Border Detection Grid
  - UAV Program
  - Automated Scene Understanding

Container Security

Detect Persons and Contraband at Borders and POE's

- Current Capability
  - All containers are assessed using National Targeting Center (NTC)
  - Integrity depends on seals which can be circumvented
  - Targeting depends on manifest data and rule based systems
- Interim Capabilities
  - A container security device that assures container integrity
  - Reporting through a global tracking and communications system which gives the container travel and history
  - Reliable container communications when the container is blocked from any line-of-sight link when stacked on a ship or in a terminal yard.
- Desired Capability End-State
  - Revamped end-to-end supply chain with operations with
    - Visibility before stuffing
    - Visibility at the sub-container level
    - Automated detection and targeting of contraband
- Residual Risk
  - Non-containerized cargoes (bulk)
- Programs
  - ACSD
  - Marine Asset Tag Tracking System (MATTS)/Radio Frequency Identification (RFID) Integration
  - Advanced Material Container
  - Secure Carton

Observations

- Operational and Organizational challenges and Fiscal Constraints
- Sometimes the best solution is low tech or no tech
  - Not everyone is Mr. Wizard
- Info to the tactical level in a timely manner important to field personnel

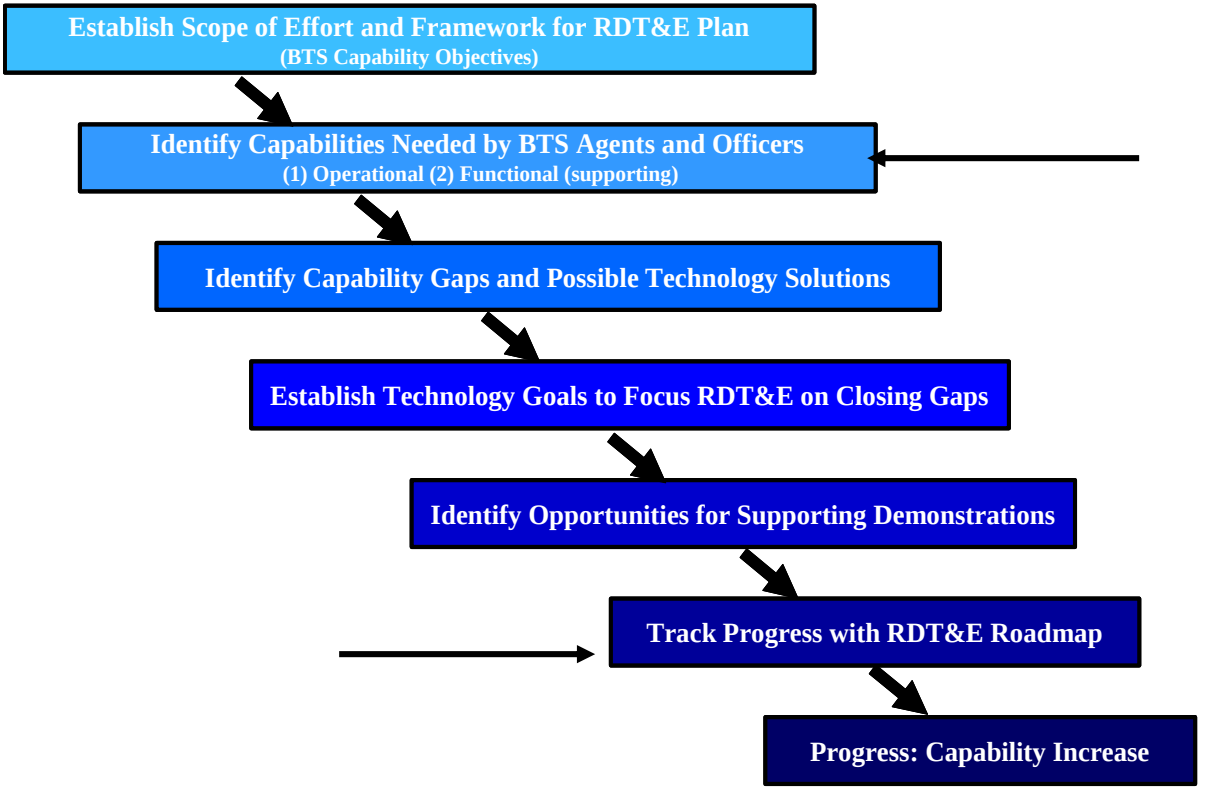
Observations (cont'd)

- Technology Transition and Lessons Learned (i.e. COP, Blue Force Tracking)
- Develop Architectures and Integrate Systems
- Broad-based systems view needed
  - How does technology insertion or process change impact operations, policy?
  - What are policy implications to technology or process?

Capabilities-Based Tech Planning

Where We Are Today

Capabilities-Based Planning Process



Capability-Based Planning works for S&T/Border and Transportation Security!

Homeland Security

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Homeland Security



Homeland Security

Joint Capabilities Integration & Development System









Urgent Needs
&
JCIDS

19 April 2005

Joint Staff / J-8
Capabilities and Acquisition Division

Joint Rapid Action Cell
&
JS Urgent Needs Process Integration & Synchronization

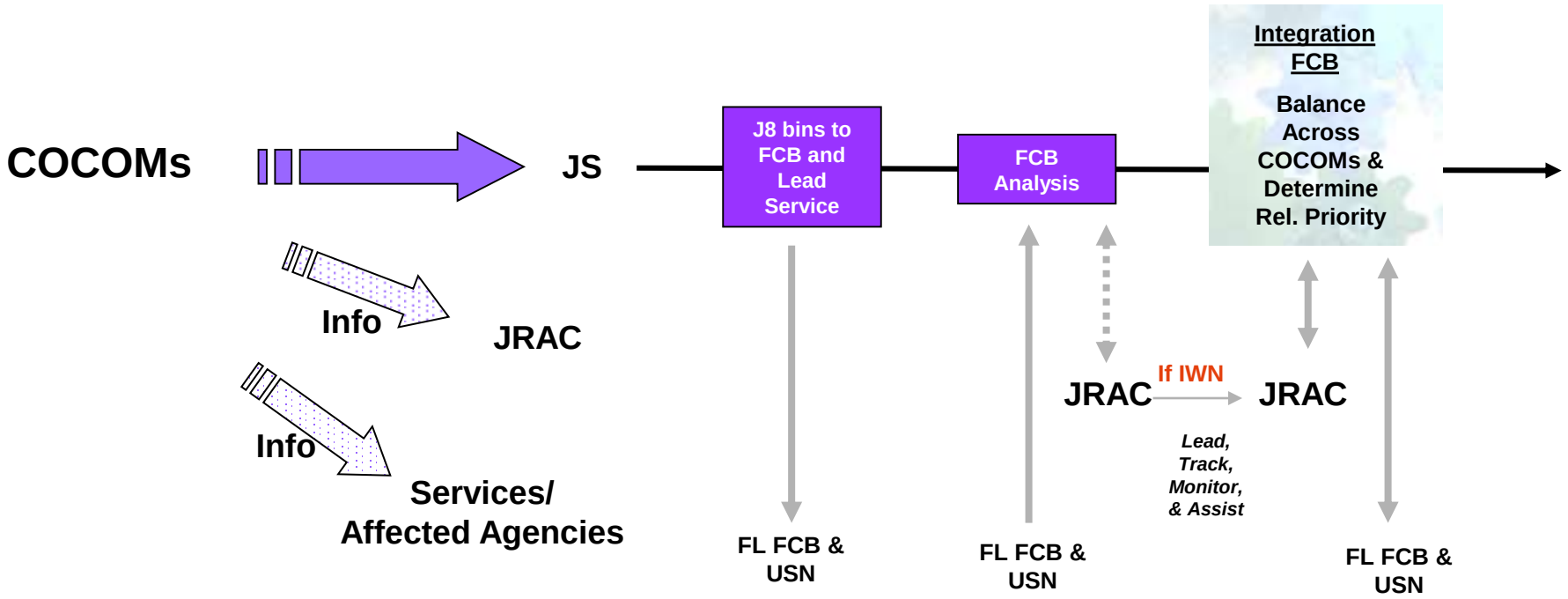
Process Integration

Prioritized Jnt Urgent Needs Shortfall

< 48 hrs

<= 2 wks + 2 days

w/in 30 days of Receipt



Recommended
- Solution
- Schedule
- Resourcing Options (e.g. Supp, Mid-Yr, etc)

Process Integration (cont'd)



w/in 30 days of Receipt

w/in 40 days of Receipt

Integration FCB

Balance Across COCOMs & Determine Rel. Priority

RECOMENDATION

OSD-C Led, JS, & Service/Agency Senior Financial/Budget Officers BOD

Decision on Solution, Schedule, & Resourcing

Exit Criteria

COCOMs

JRAC

Lead, Track, Monitor, & Assist

FL FCB & USN

JRAC

Ensure 120 day cap is not broached

JRAC

SECDEF

USN & FL FCB

Roles & Responsibilities

"New" JS Process: How we Validate, Fulfill, & Resource

- Receive validated & prioritized Jnt Urgent Operational Needs (JUONs) from COCOM
- In harmony w/Lead Service develop candidate solutions, schedule , & resourcing
- Integrate the priority of submitted JUON w/in the COCOM and across multiple COCOMs
- In harmony w/Lead Service recommend strategy to OSD-C led BOD

JRAC: Oversight, Assistance, & Follow Through

- Receive copy of JUONs
- Evaluate proposed solutions during JS-led process
- Identify appropriate materiel & logistics solutions as IWNs
- Attend Integration meetings that address identified IWNs
- Attend OSD-C led BODs that address IWNs
- Assist throughout JS process in solution building, barrier removing, etc
- Monitor completion and highlight "lates" to SECDEF

Joint Capabilities Integration & Development System

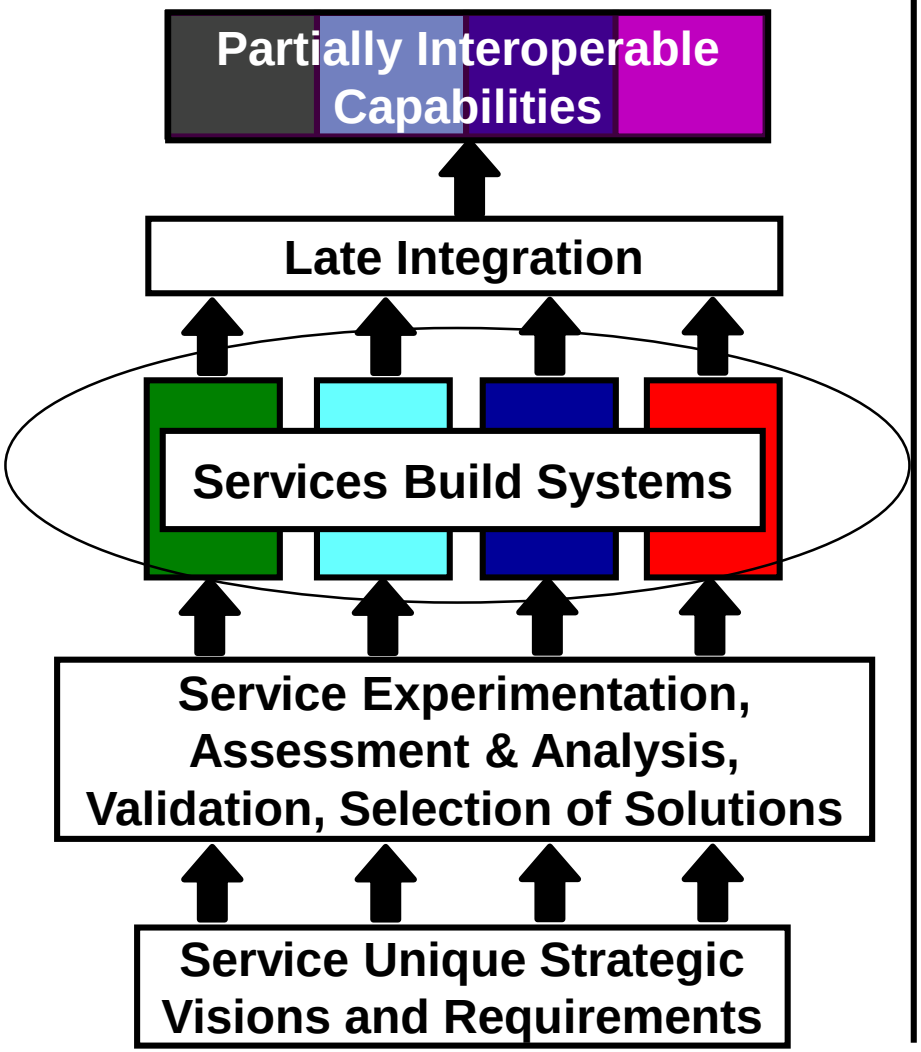
(JCIDS)

Previous Requirements and Acquisition Process

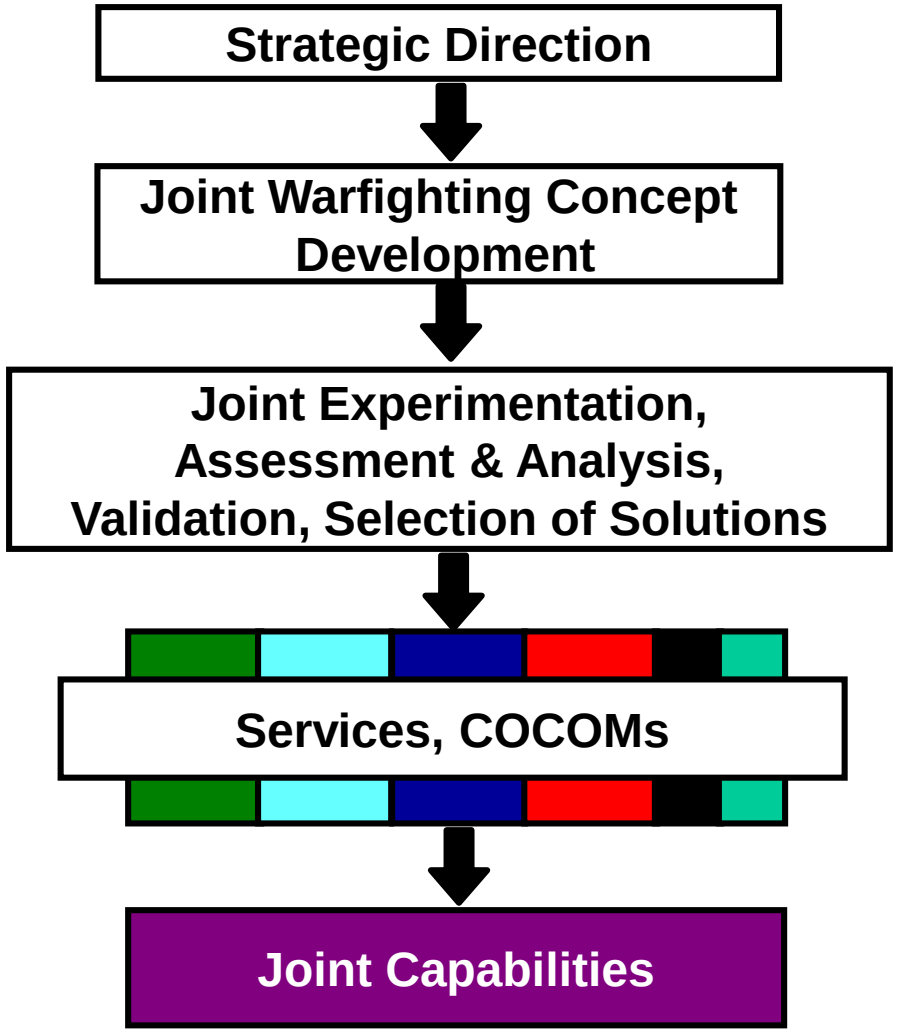
- **As a rule, CONOPs and requirements were Service-focused**
- **Analysis was primarily threat-based**
- **Process lacked a construct for Joint analysis "up-front"**
- **Systems integration tended to be forced in at end game**
- **Duplication existed, particularly in smaller programs**
- **Spiral acquisition was not well institutionalized**
- **Joint warfighting needs were not prioritized**

Capability Based Methodology

Requirements Generation System (RGS)- ~30 years of experiences

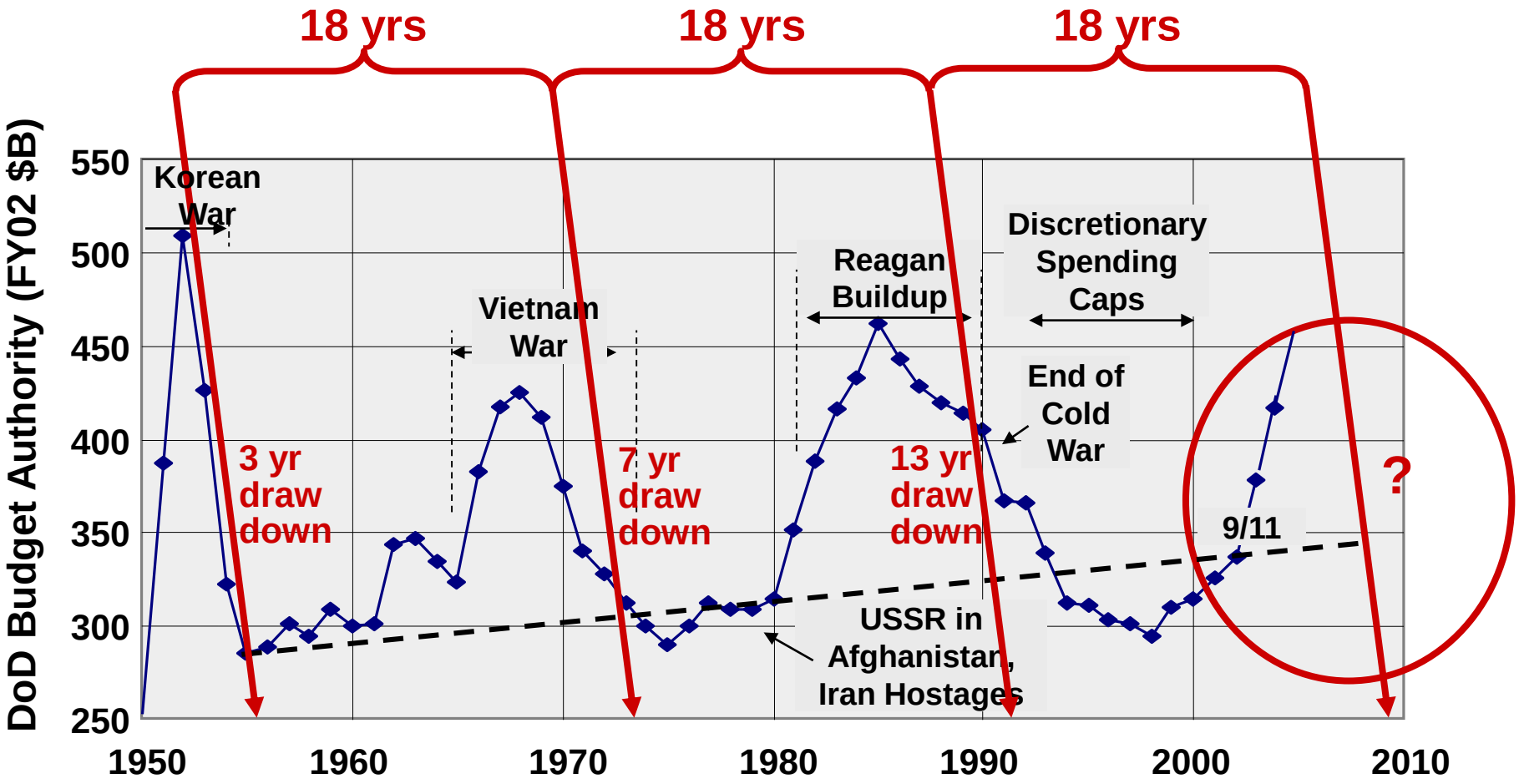


Joint Capabilities Integration and Development System (JCIDS)- 1.5 years old



Why Get it Right Now?

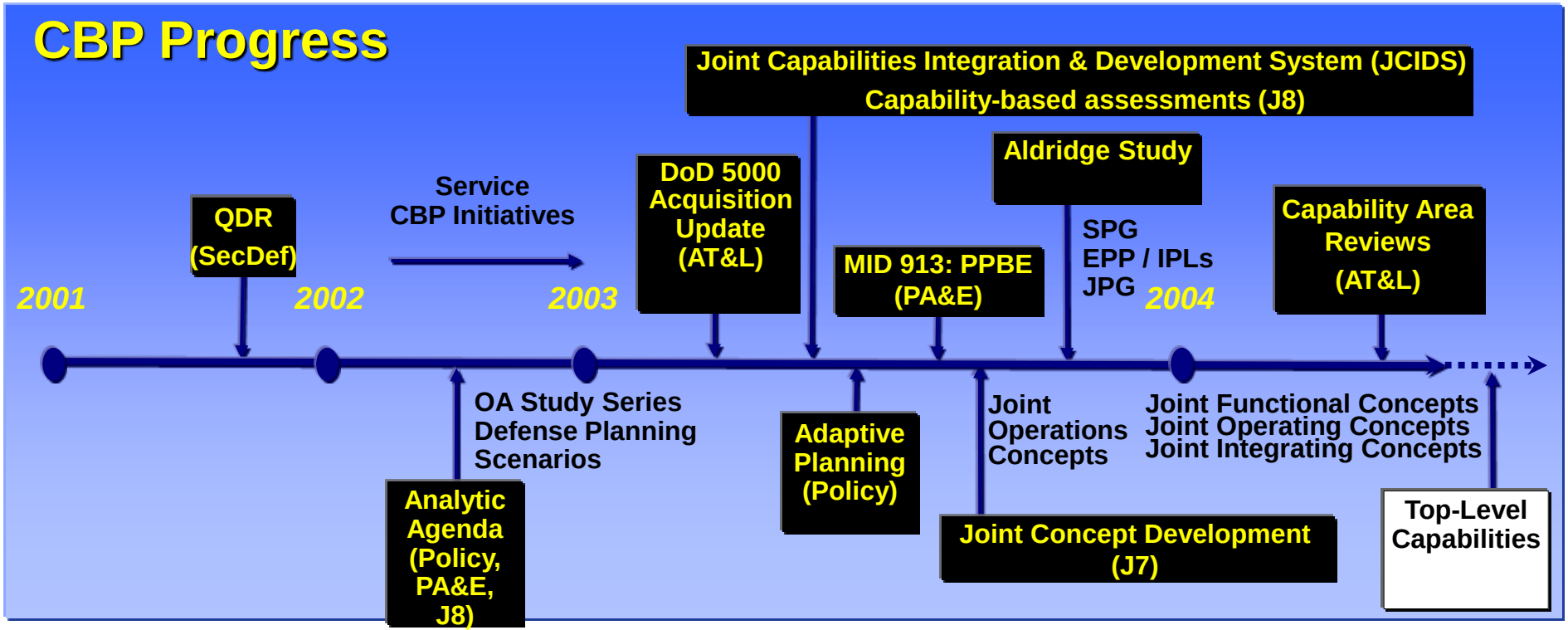
Will the cyclic pattern in defense spending continue?



Real DoD Growth Rate, 1955 – 2002 = 0.4%

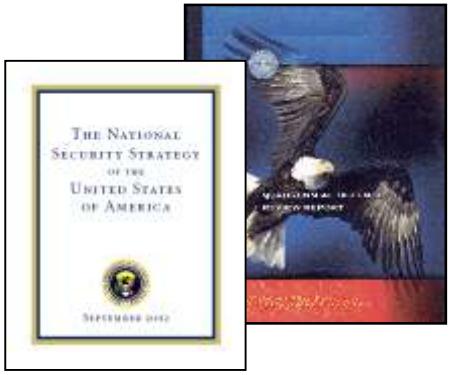
New Capabilities-Based Processes

❑ PPBS, the last major change in DoD resource management (1960s), was based on a decade of prior analytical development

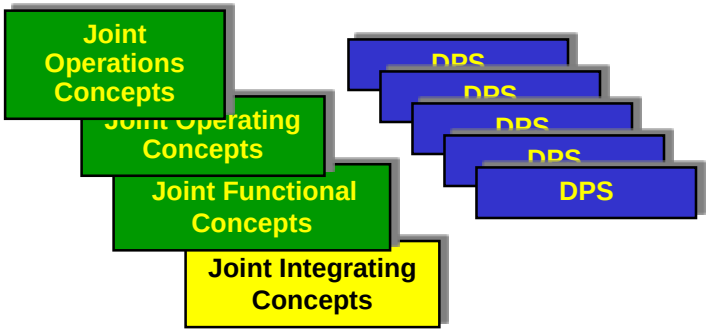


JCIDS Evolution – Concepts to Capabilities

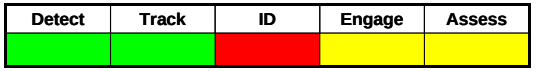
Strategic Guidance



Joint Concepts and MSFD scenarios

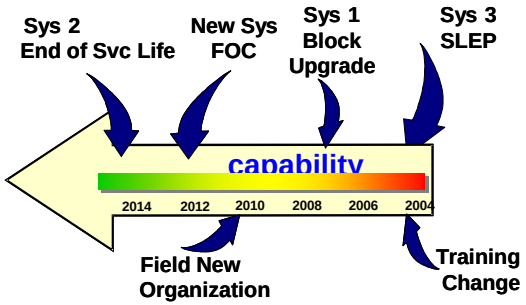


First order assessment using operational tasks and force elements



SecDef | **Joint Chiefs of Staff** | **Joint Requirements Oversight Council**

Capability Roadmap & Resource Strategy



Provide DOTMLPF Solutions

Initial Capabilities Document

Operational Modeling to identify gaps and excesses



Secretary of Defense | **Services** | **Joint Requirements Oversight Council**

Operational Availability

- Operational Availability Studies assess mid-term (end of program) warfighting scenarios

- Each Operational Availability Study leverages previous efforts (tools, data, personnel)—large pool of capability

- Collaborative effort of OSD, Joint Staff, Services, and COCOMs

OA-03

- Multiple- theaters
- Warfight focus: analyze "Swiftly Defeat" concept

OA-04

- Single theater
- Warfight focus: Assess overlapping regime change and Swiftly Defeat
- Post-hostilities ops

OA-05

- Multiple warfights
- Assess full range of military ops over a 7-year time-frame
- Assess full range of capabilities

Expanding scope of analysis:

- Across the range of military ops
- Advancing metrics and tools
- Capability assessments

Tier 1 Capabilities – Starting point for OA

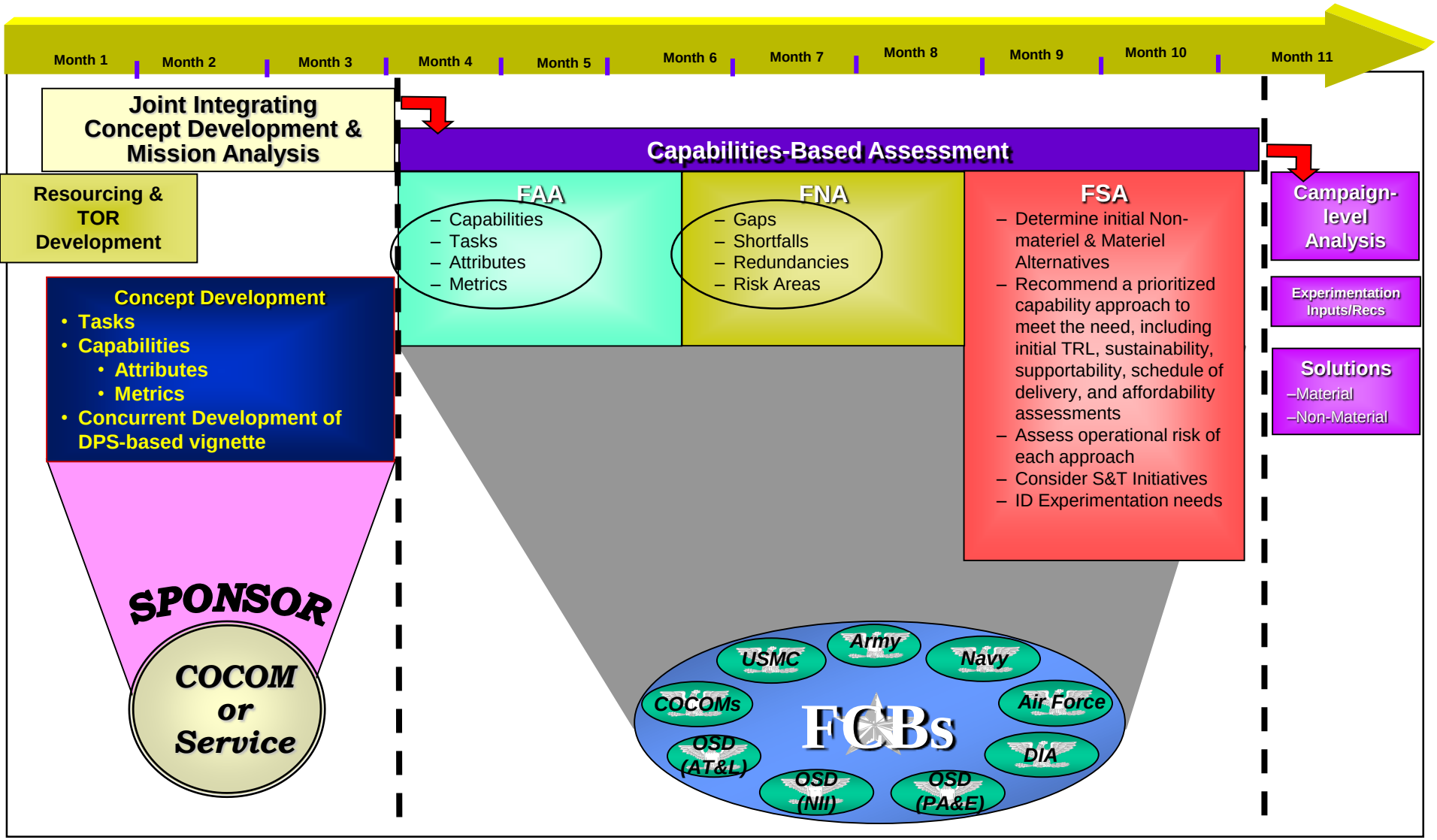
- Battlespace Awareness
- Command and Control
- Net-Centric Operations
- Interagency Integration
- Information Affairs
- Information Operations
- Protection
- Logistics
- Force Generation
- Force Management
- Homeland Defense
- Strategic Deterrence
- Shaping & Security Cooperation
- Stability Operations
- Civil Support
- Non-Traditional Operations
- Access & Access Denial Operations
- Land Control Operations
- Maritime/Littoral Control Operations
- Air Control Operations
- Space Control Operations

These would serve as a common lexicon for various CBP processes

Tier 2 Capabilities - Starting Point for CBA

- **Homeland Defense**
  Security of the Mobilized Force, Bases, Reach-back Infrastructure, National Infrastructure; Continuity of Operations, Securing Domestic Approaches & Territory, Critical Infrastructure Protection (CIP), Population Protection, Homeland Air & Missile Defense
- **Strategic Deterrence**
  Overseas Presence, Force Projection, Global Strike
- **Shaping & Security Cooperation**
  DoD Support to Nonproliferation, Security Assistance, Theater Security Cooperation Inducements
- **Stability Operations**
  Peace-Keeping, Security, Humanitarian Assistance, Foreign CM, Civil Affairs, Reconstruction, Transition
- **Civil Support**
  Military Assistance to Civil Authorities (Military Support to Civil Law Enforcement Activities (MSCLEA) & Military Assistance to Civil Disturbances (MACDIS)), Consequence Management (Domestic), Counter-Drug Operations, Continuity of Government
- **Non-Traditional Operations**
  Unconventional Warfare, Direct Action, Counterterrorism, Counterproliferation of WMD, Foreign Internal Defense, Insurgency/Counter-Insurgency Support, Special Recon
- **Access & Access-denial Operations**
  Operational Access, Forcible Entry, LOC Protection, Freedom of Navigation, Basing (Including Sea Basing), Blockade, Quarantine
- **Land Control Operations**
  Offensive Land Ops, Defensive Land Ops, Retrograde Land Ops, Operational Mobility, Control Territory, Populations, and Resources
- **Maritime/Littoral Control Operations**
  Surface Warfare, Undersea Warfare, Maritime Interdiction Operations, Anti-Sub Warfare, Mine Warfare
- **Air Control Operations**
  OCA, DCA, SEAD, Strategic Attack, Theater Missile Defense, Force & Supply Interdiction, Airspace Control
- **Space Control Operations**
  Offensive counterspace operations, Defensive counterspace operations

The JROC Capability-Based Assessment Process



DOD End-to-End Capabilities, Acquisition, and Test Process

DAB Capability Area Reviews (CARs)

- Strategic Planning Guidance
- Defense Planning Scenarios
- Family of Concepts
- Transforma-tion

Capabilities Based Assessment

- Capabilities
- Tasks
- Attributes
- Metrics
- Gaps
- Shortfalls
- Redundancies
- Risk areas
- Non-materiel solutions
- Materiel solutions
- S+T initiatives
- Experimentation

- Refined concept
- Analysis of Alternatives
- Technology Development Strategy
- SoS System Engineering

- Affordable military-useful increment
- Technology demonstrated
- Initial KPPs
- SEP

- Revise KPPs
- Detailed design
- System integration
- DT&E

- LRIP
- IOT&E

activity

Select a Joint Integrating Concept | Develop Concept | Functional Area Analysis | *Functional Needs Analysis | *Functional Solutions Analysis | ICD | Concept Decision | Analysis of Alternatives | MS "A" | Technology Development | MS "B" | CDD | System Development | CPD | MS "C" | Production

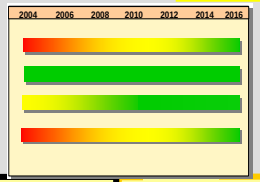
Capability Based Assessment

OSD (AT&L)-led Capability Roadmaps

Evolutionary or Spiral Development

OSD/JCS | COCOM | Services

FCB: USMC, Army, Navy, COCOMs, Air Force, OSD (AT&L), DIA, OSD (NII), OSD (PA&E)

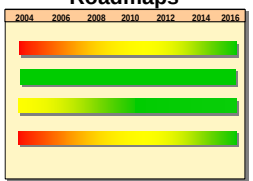


oversight

SecDef | Joint Chiefs of Staff & Joint Requirements Oversight Council | Joint Staff / OSD | OSD (AT&L, PA&E), Services and OSD (DOT&E) -- Joint Staff (JROC)

Policy | *Capabilities Definition* | *Concept Refinement* | *Acquisition and Test*

*"as is" Roadmaps



JCIDS Updates

- Incorporated DOTMLPF Change Requests (CJCSI 3180)
- Insensitive Munitions Certification Process
- Transition of ACTDs into the JCIDS process
- COCOM ICD submissions
- Incorporation of business systems
- Increased emphasis on JICs versus architectures
- Key Performance Parameter Guidance

JCIDS Lessons Learned . . .

- Building a process "on the fly" presented several challenges
  - False starts, dead ends, institutional inertia, etc.
- We have made good headway building the necessary tools
  - Adoption of JICs, 1st Order analysis tools, OA Studies
- Assessments like to gravitate into "the weeds"
  - CBAs need to stay focused at the JTF and Department levels
- Right blend of analysis & operational expertise is important
  - JCIDS must be timely and responsive . . . Start with 80% solution
- Defining gaps is important, but so is identifying trade space
  - If the FCBs don't address trade space, someone else will
- The first CBAs are not pretty . . .
  - But the process can provide a methodical, responsive framework for addressing future challenges

?Questions?

JCIDS

Points of Contact

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Mr. Bill Cooper	***(703) 697-7525***
Col Matt Mulhern	***(703) 693-4520***

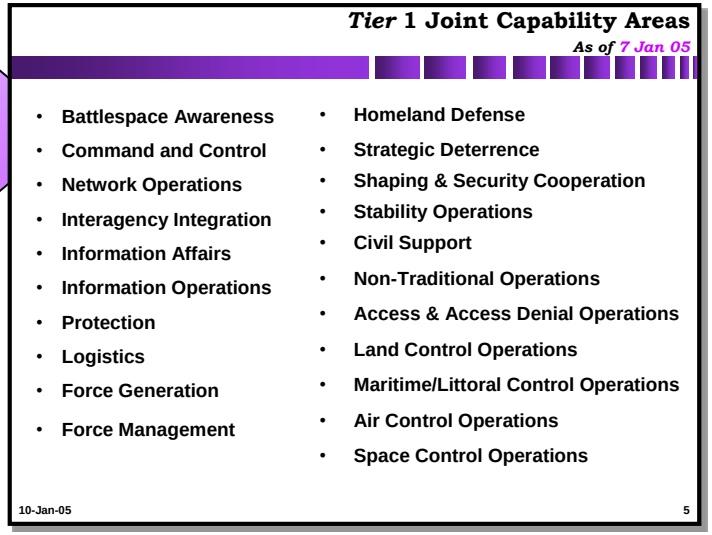
Joint Staff / J-8
Capabilities and Acquisition Division

Back UP

What Constitutes a Tier 1 Joint Capability Area?

TIER 1 CONSTRUCT

- **Capability Areas** generated and provided to **a regional COCOM by a supporting COCOM, Agency, or Service**
- **Capability Areas** delegated by **a CJTF to one of his component commanders for execution as the 'supported commander'**
- **Capability Areas** provided through **a Regional COCOM to a CJTF** for execution by **one of the JTF staff principals in order to deliver specific functional capability across all the components of the JTF**
- **Capability Areas** identified by senior leaders **for Tier 1 visibility**



Joint Capability Areas are those capability areas typically *received, managed, delegated, and/or executed* at the CJTF level.

- Received: Capabilities typically received at the CJTF level from a supporting COCOM, Agency, or Service
- Managed: Functional or enabling capability areas typically applied across the JTF; normally managed by JTF-level staff principals
- Delegated: Operational capability areas typically "delegated" to a component commander within a JTF for execution.
- Executed: Joint Capability Areas worthy of or requiring CJTF-level emphasis, integration, and oversight.

FY 06 IPLs and the JPG

IPLs
(115 issues)

Department-Level Assessment

Functional Capability Boards

Services, CoComs, OSD, JS

COCOM/JROC Hub Trip

69 Capability Gaps
(within 30 Capabilities Areas)

- Assume Risk
- Under Study
- Program on Track
- Adjustment Required

Where to Adjust

- POM 06
- Program Review
- POM 08

OSD PAE Led

Three Star Programmers
Assess Offsets

FCBs, Services, CoComs, OSD, JS

JPG

19 Capability Gaps

+ 6 additional Capability IPLs

Fall PR/BR

25 Capability Gaps Filled

Bounding Strategic Challenges

LIKELIHOOD

Higher

Lower

Irregular

- Non-state and state actors employing "unconventional" methods to counter stronger state opponents—terrorism, insurgency, etc.

Catastrophic

- Terrorist or rogue state employment of WMD or methods producing WMD-like effects against American interests.

Traditional

- States employing military forces in well-known forms of military competition and conflict.

Disruptive

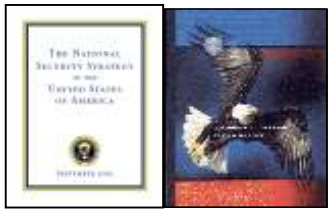
- Competitors employing technology or methods that might counter or cancel our current military advantages.

Lower — VULNERABILITY — Higher

Increased focus on irregular, disruptive and catastrophic capabilities

JROC Capabilities Based Process

OSD Policy
Strategy
Strategic Guidance
(e.g., JopsC)



Irregular	Catastrophic
Traditional	Disruptive

Defense Planning Scenarios

1-4-2-1 and 'stretch goals' (10-30-30)

JROC macro

Warfighting Capabilities and corresponding force structure

Operational Availability Assessments

JCIDS
For material and non material solutions

Functional Capability Boards micro

Joint Concepts (e.g., JICs)

Capabilities Based Assessments

Capabilities Gaps and Overlaps

JROC Capabilities Based Process

Defense Planning Scenarios

1-4-2-1 and 'stretch goals' (10-30-30)

Irregular	Catastrophic
Traditional	Disruptive

OSD Policy
Strategy

Warfighting Capabilities and corresponding force structure

J8
macro

Operational Availability Assessments

Capabilities that
Reveal risk or
Excess overmatch

Functional Capability Boards
micro

Future Force

Unclassified Working Papers

Joint Forceable Entry Operations

Joint Integrating Concept

Future Capability

Joint Concepts (e.g., JICs)

Capabilities Based Assessments

Validate capabilities gaps and excesses

New Overarching JCIDS Document

Joint Capabilities Document (JCD)

- Create a new document to capture COCOM and joint warfighting capability needs
  - Joint Capabilities Document (JCD)
  - Incorporates results of the FAA and FNA
  - Prioritizes the gaps based on mission impact
  - Recommends sponsors to perform the FSA and develop an ICD for the gaps
- This new document will be developed by COCOMs or FCBs
  - Sponsors may develop after pre-coordination with the FCBs and COCOMs

Insensitive Munitions Certification

- **Roles and Responsibilities changed to reflect J8/DDFP role in certification (shifts from J4)**
- **FCB role in assuring certification or processing of waiver through the JROC defined**
- **Staffing process updated to reflect IM Cert incorporation**
- **Before proceeding to JCB/JROC program will be "certified" or have waiver being processed in parallel**

Congressionally Mandated KPPs

- **Congress mandated KPPs on Force Protection and Survivability for:**
  - **Systems employed in a asymmetric warfare environment**
  - **That are :**
    - **Manned**

      or
    - **Designed to enhance personnel survivability**
  - **Does not apply to systems that have entered LRIP**

- **OSD AT&L Policy guidance being developed**
- **JROCM with transition guidance being developed**

Joint DOTMLPF Change Requests

- **Incorporating the Joint DCR into 3170 will bring the two processes into synch**
- **The merge resulted in two changes**
  - **Incorporate the DCR format as is**
    - **DCRs will be staffed through the standard KM/DS process**
    - **Emergency DCRs will have an expedited process (Flag review only)**
  - **Change the ICD format**
    - **The FSA may identify a non-materiel change as an alternative**
- **Working on a new implementation oversight process using the JCB**

Transition of ACTDs

- The process for transitioning ACTDs into the JCIDS/Acquisition process defined
- ACTD development and execution is under the direction of AT&L
  - Selection of ACTDs is done with the advice of the JROC (FCBs)
- Transition methodology for successful ACTDs defined
  - Entry at MS B
    - MUA substitutes for ICD
    - CDD will be written for MS B
  - Entry at MS C
    - MUA substitutes for ICD
    - CPD will be written for MS C
- If the ACTD is being merged with an existing program – CDD is updated to reflect changes

Guidance on Key Performance Parameters

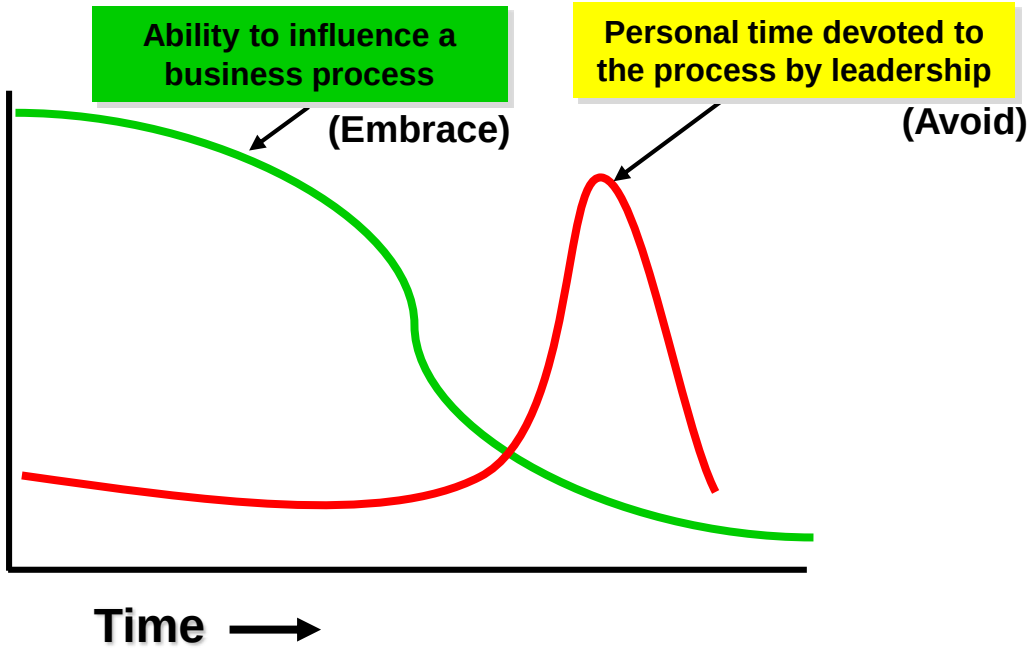
- **Each KPP should be:**
  - **Traceable to one or more capability characteristics in an Initial Capabilities Document (ICD) and/or support the attributes identified in the Joint Operations Concepts**
  - **Measurable and testable**
- **Deviations from KPP thresholds will be considered by the validation authority**
  - **KPP changes are approved by the validating authority**
  - **Is the reduced capability still operationally effective?**
    - **What is the risk to mission accomplishment?**
  - **Is there a plan to meet the original threshold in a future increment?**

Legacy Mission Area ICDs

- Directed via JROCM in Jun 04
- Converting CRDs to MA ICDs required compromising the ICD format to incorporate key aspects of the CRDs
  - KPPs versus Measures of Effectiveness
  - Architecture products beyond an OV-1
  - CRD crosswalk
  - FSAs may or may not have been done
- Recommended grandfathering guidance
  - No further MA ICDs to be developed
  - When updated, MA ICDs should be converted to either ICDs or JCDs
  - CRD crosswalks will continue to be used until MA ICDs converted to new documents

JROC Impact using JCIDS

- **Desired Attributes of DOD Decision Process**
  - **Responsive**
  - **Flat**
  - **Involve leaders "when it counts"**
  - **Agree on facts**
- **New 3170.01D**
  - **Top down**
  - **Born "Joint"**
  - **Tees up issues with wider input earlier in the process**



Action Agent:

Functional Capabilities Boards

New JCIDS Documents

- **Joint Capabilities Document (JCD)**
  - Identifies capability gaps or other deficiencies
  - Supports development of one or more ICDs
  - Developed primarily by COCOMs and FCBs
  - Can be developed by a sponsor under certain conditions
  - Updated as required
- **Joint DOTMLPF Change Recommendation (DCR)**
  - Identifies an approach to filling a capability gap through non-materiel changes
  - Developed primarily by COCOMs
  - Formerly described in CJCSI 3180.01

Joint Capabilities Document (JCD)

Purpose of the JCD:

- **Describes capability gaps as determined by the functional area and needs analyses**
- **Identifies the relative importance/priority of the gaps**
  - **Highlights capability gaps that are important enough to justify pursuing a solution**
  - **Identifies gaps where risk may be taken`**

When is a JCD required?

- **COCOM generates based on emerging/changing missions**
- **FCBs generate based on the results of a JIC**
- **Sponsors may generate when pre-coordinated with COCOMs and FCBs**

Conclusions on JCIDS

- Provides an enhanced methodology to identify and describe capabilities gaps and redundancies
- Helps to prioritize capability proposals
- Facilitates broad review of capability proposals independent of ACAT (Acquisition Category)
- Engages the acquisition community early
- Improves the identification of non-materiel alternatives
- Improves collaboration with other departments and agencies

JCIDS Documents

- **Initial Capabilities Document (ICD)**
  - Identifies a capability gap or other deficiency
  - Describes evaluation of DOTMLPF approaches
  - Supports AoA, Concept Refinement and Milestone A
  - Not normally updated once approved
- **Capability Development Document (CDD)**
  - Identifies operational performance attributes of proposed system
  - System specific, applies to single increment (in an evolutionary program)
  - Results from Technology Development and supports Milestone B
  - Updated or rewritten for subsequent increments
- **Capability Production Document (CPD)**
  - Identifies production attributes for a single increment of a program
  - Prepared during System Development and Demonstration
  - Rewritten for each increment in a evolutionary program

United States Joint Forces Command

Emerging Concept for Joint Command and Control

Mr. David J. Ozolek
Executive Director
Joint Futures Lab
US Joint Forces Command (J9)

Why have a new JC2 concept?

- A new threat – globally networked
- The information avalanche
- Speed of operations
- Complexity of operations
- Global visibility and connectivity

Joint Command and Control

- Command remains command
  - Command and control are different but inter-related
  - Command remains vested in a single individual with authority and responsibility for making the big decisions
  - Control, however, is undergoing a significant re-examination

Joint Command and Control Coherence

Deconflict
Service Forces



Coordinate
Stitch Service Seams



Integrate
Services/SOCOM Capabilities



Coherently Integrate
Interdependent, Collaborative, Learning & Adaptive Coherently Joint Force



Result:
Effects-Based Outcomes

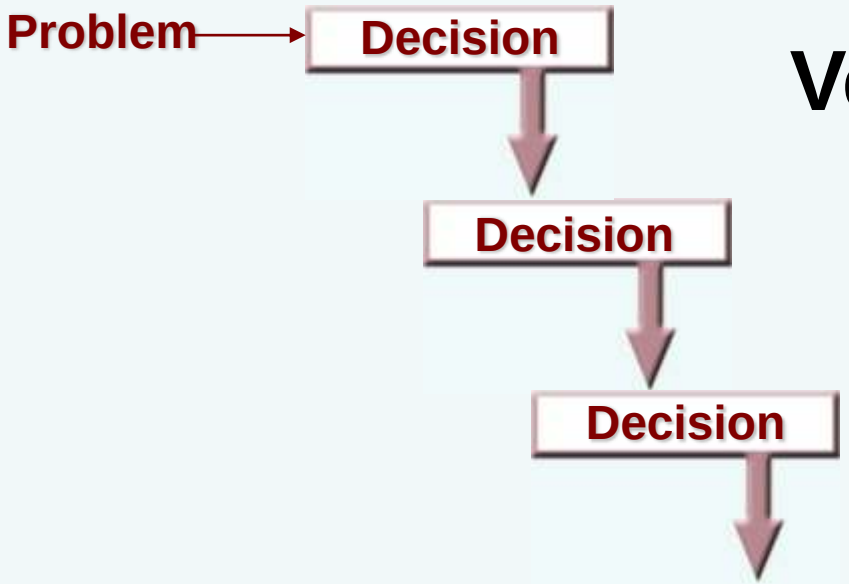
Supported/Supporting Relationships

Distributed Operations

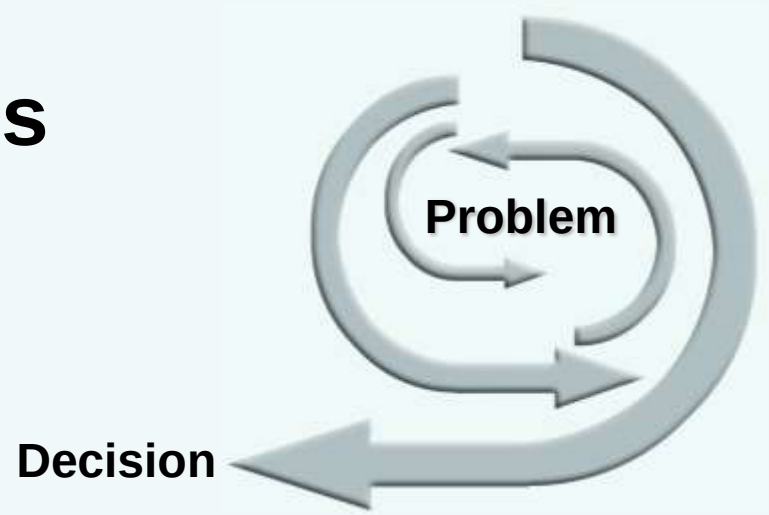
- Two dimensions:
  - Physical (non-contiguous operations)
  - Functional
    - Collaboration
    - Distributed problem solving
    - Adaptive decision making

Collaboration

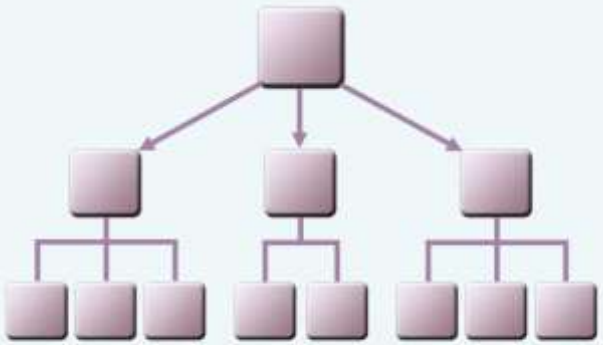
Using a shared information environment to span the planning and coordination activities of functions or echelons of operations



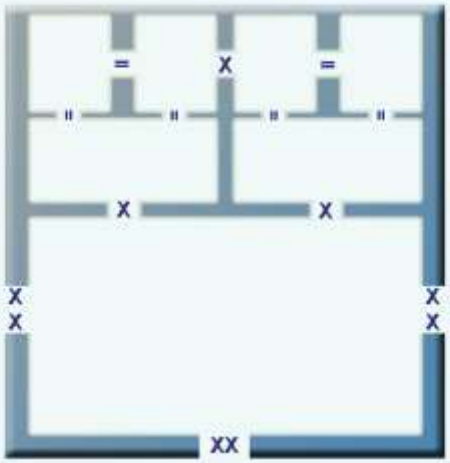
Versus



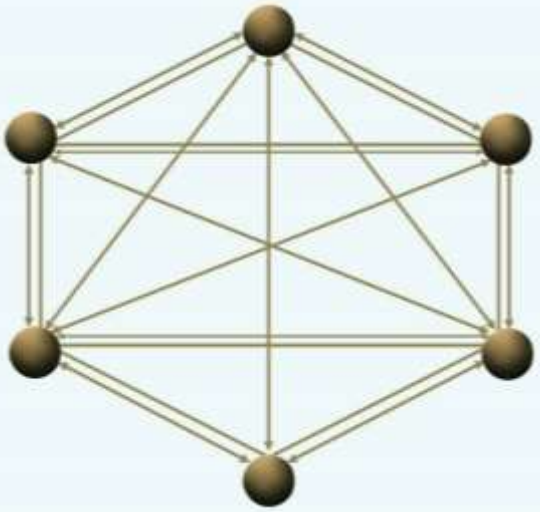
Adaptive Decision Making



Centralized



Decentralized



Distributed

Standing Joint Command and Control

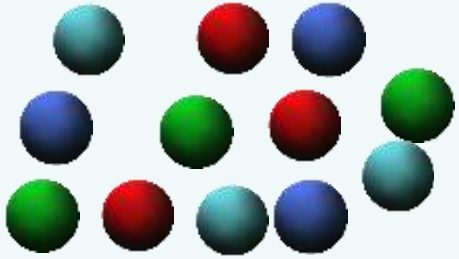
Old Paradigm:

Single Service

Army | Air Force | Navy | USMC

+

Individual "joint" augmentation skill



=

JTF Headquarters

New Paradigm:

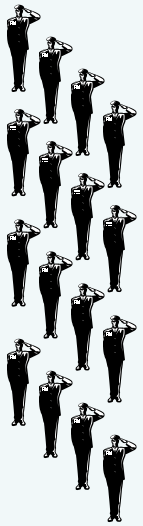
Standing Joint Force Headquarters



+

Service Manpower

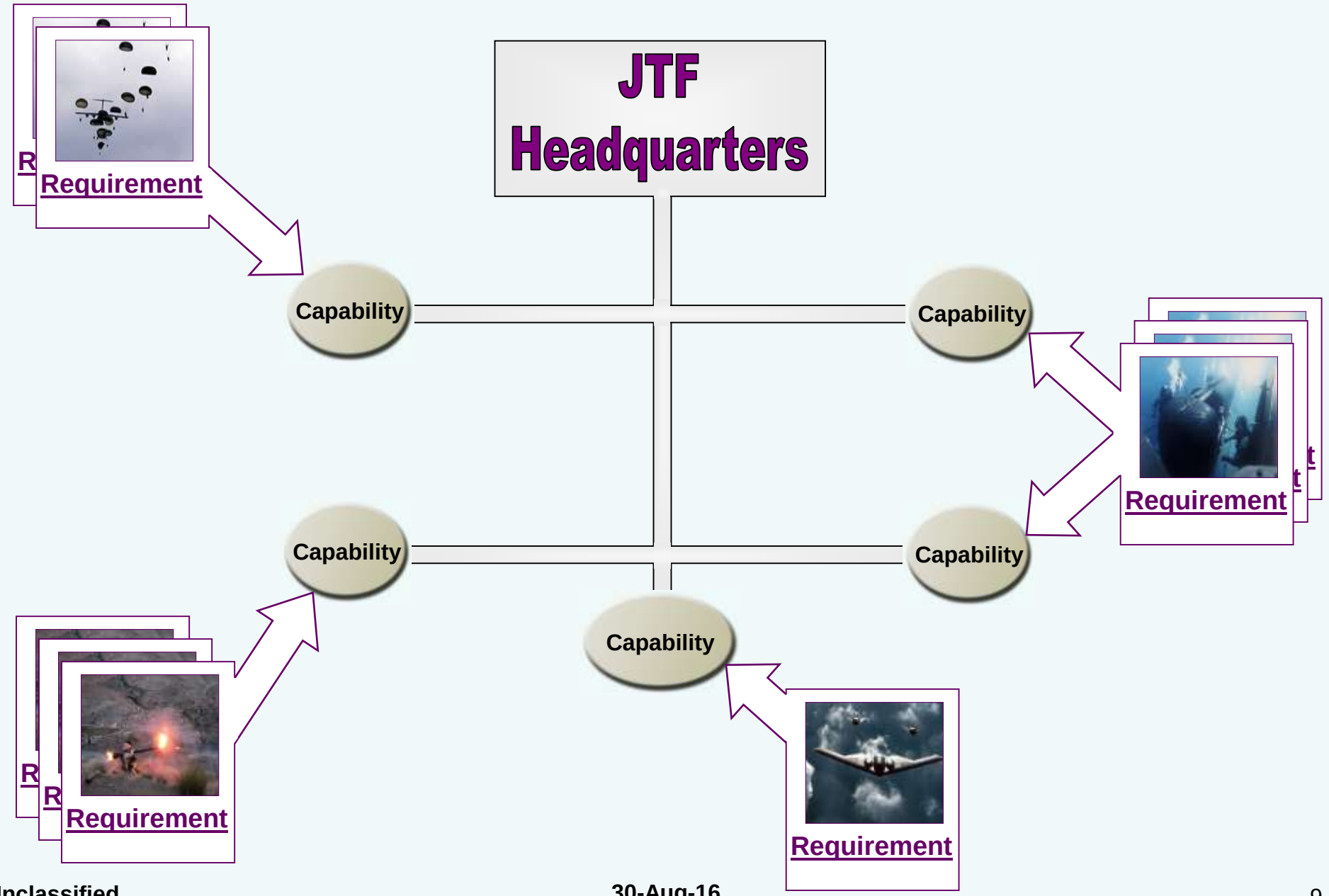
Army | Navy | Air Force | USMC



=

JTF Headquarters

Dynamic Tasking of Modular Capabilities



Componency

Today: **Service**

Functional (really domain)

- **Air**
- **Land**
- **Sea**

Next: **True functional**

- **Strike?**
- **Info Superiority?**
- **Sustainment?**
- **Other?**

Next Big JC2 Hurdle

Coherent Interagency Operations

in a

Coherent Multinational Context

Questions?

Getting Technology to the Warfighter

Ms. Sue Payton
DUSD (AS&C)/Dep. DDR&E
(Acting)
April 20, 2005

Who is the Warfighter?

Military Services

- *Core Military/Service-specific capability providers*
- *"…to organize, train and equip…"*

Joint Combatant Commands

- *Military capability end-user –* ***the warfighters***

What are Joint Capabilities?

AS&C Program Perspective

Multi-Service Core Military Capabilities.

Common denominator Military forces provided worldwide as self-integrated, self-sustaining echelons by the Services.

(Global Positioning System, Movement Tracking System)

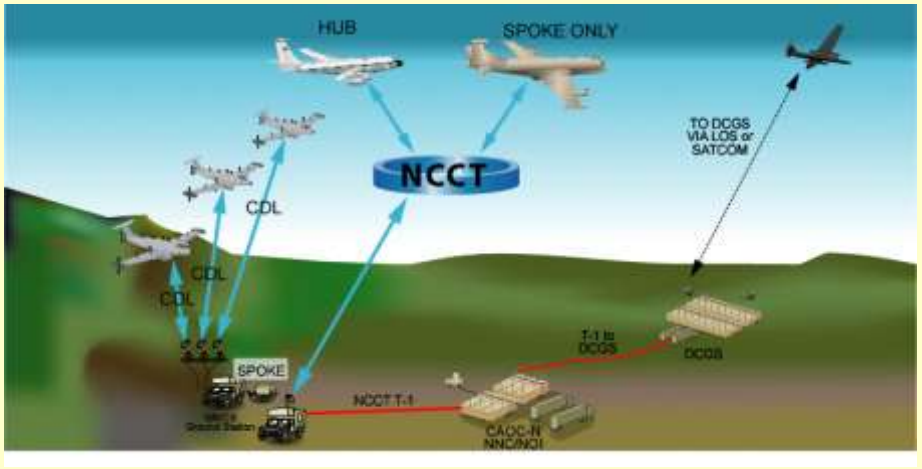
Joint Enabling Capabilities.

Additional capabilities required by warfighters to exercise joint command, and to enable core military elements to function effectively as a coherent joint force.

(Network Centric Operations, Common Operational Picture)

Joint is an inter-Service reliance acting together as one - not a patchwork of deconflicted Service operations.

(General Tommy Franks, excerpts from *American Soldier)*



Unique Regional/Specified Mission Requirements.

Capabilities beyond common core military capabilities required by warfighters to effectively function in operational environments associated with assigned regional or specified missions.

(Foliage Penetrating Radar, Language Translators)

Are There Valid Requirements Beyond Service-Specific/Core Military Capabilities?

Characterization of Joint CoCom Requirements:

- **Core Service-specific capabilities (~80%?)**
- **Joint Coalition military requirements (~20%?)**
  - ***Joint capability enablers* (~10% - and growing)**
  - ***Tailored regional/specified requirements* (~10%?)**

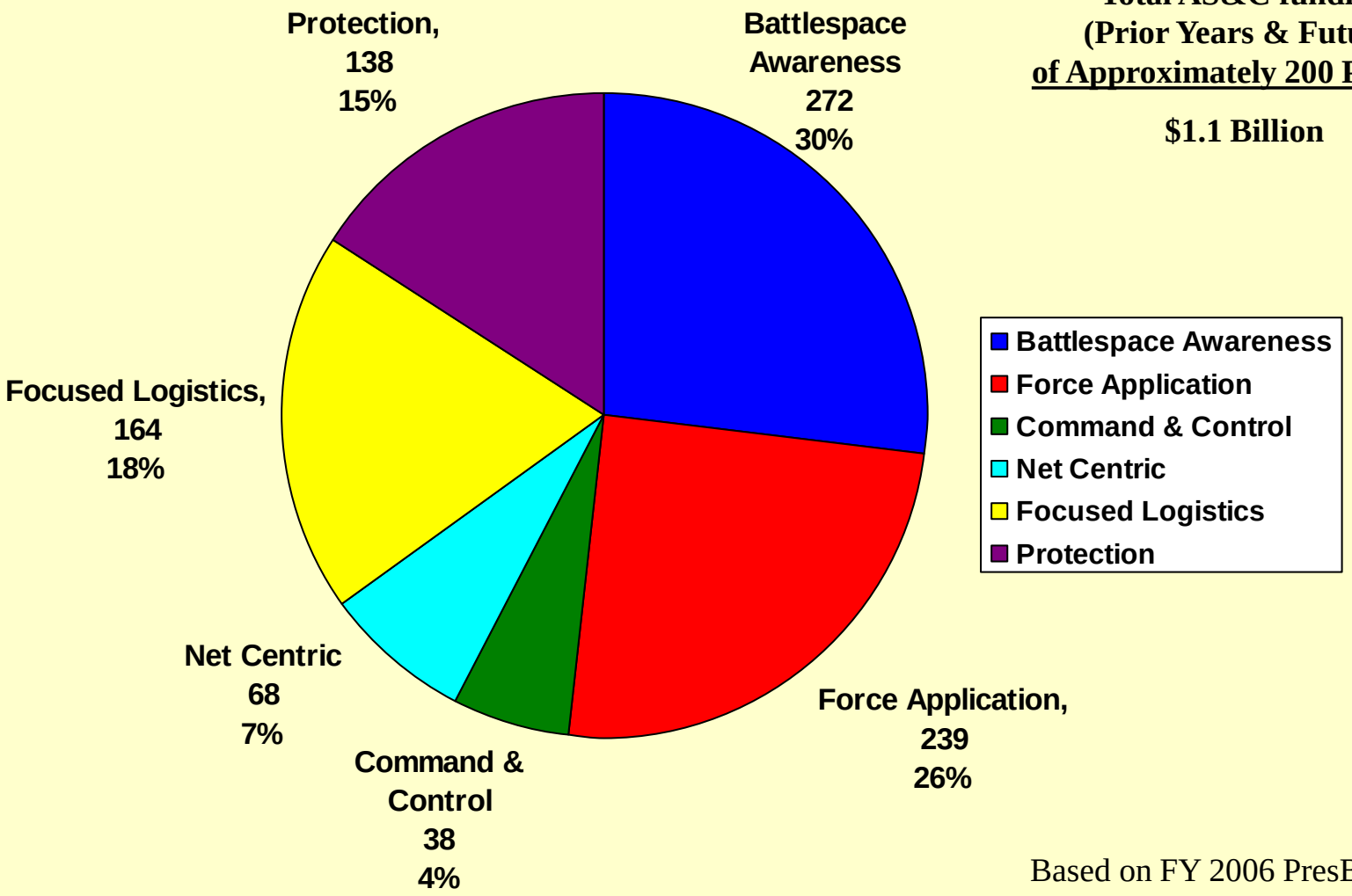


AS&C Funding Split (FYDP) by Functional Capability Area

Dollars in Millions

Total AS&C funding (Prior Years & Future) of Approximately 200 Projects

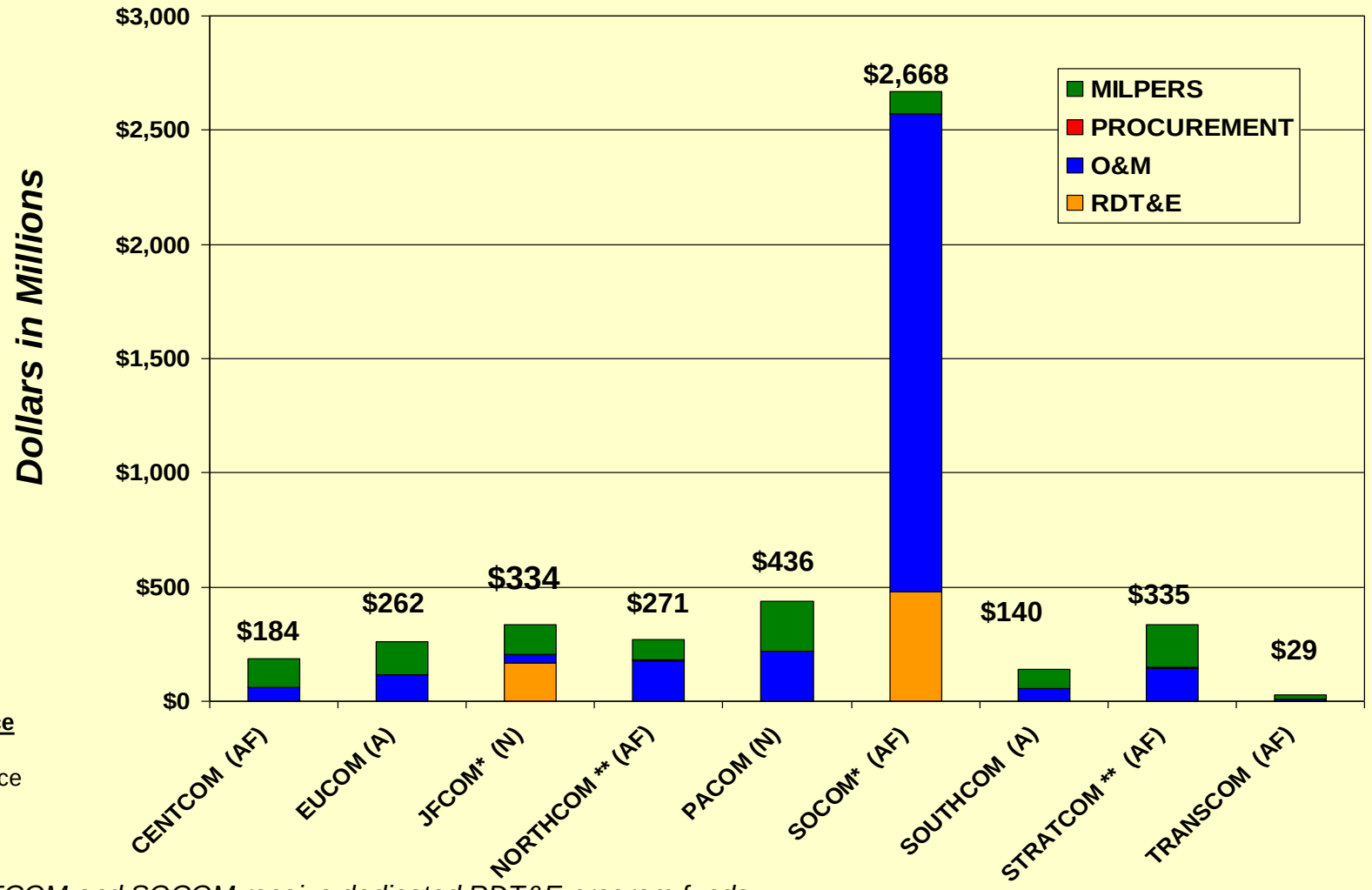
$1.1 Billion



Includes: ACTD, FCT, DACP, and TTI

Based on FY 2006 PresBud and Congressional Reports

FY-2005 CoCom Funding Support



Lead Service
A = Army
AF = Air Force
N =Navy

** Only JFCOM and SOCOM receive dedicated RDT&E program funds*
*** NORTHCOM and STRATCOM have limited Procurement funds*

Based on FY-05 PresBud Submit

Advanced Systems & Concepts

Rapidly placing relevant, mature technology into the hands of warfighters



ManTech's Focal Plane Array Cooled and uncooled IRFPAs and components for the Near IR, Mid IR, and Long IR wavebands

DoD's resource for technology transition

AS&C Partners with Services & Agencies to:

- **Match technology to warfighting needs**
- **Overcome resistance to transformational concepts**
- **Ensure technology contributes to joint capabilities**
- **Provide joint warfighters with options for integrating service capabilities**
- **Transfer DoD technology to the private sector: An industry on-ramp and access to meeting warfighter needs**



Defense Acquisition Challenge Aerogel for Ships: Fire barrier, IR Suppression, Blast Mitigation, Decreased Weight, Volume, Installation Costs, and Fuel Savings



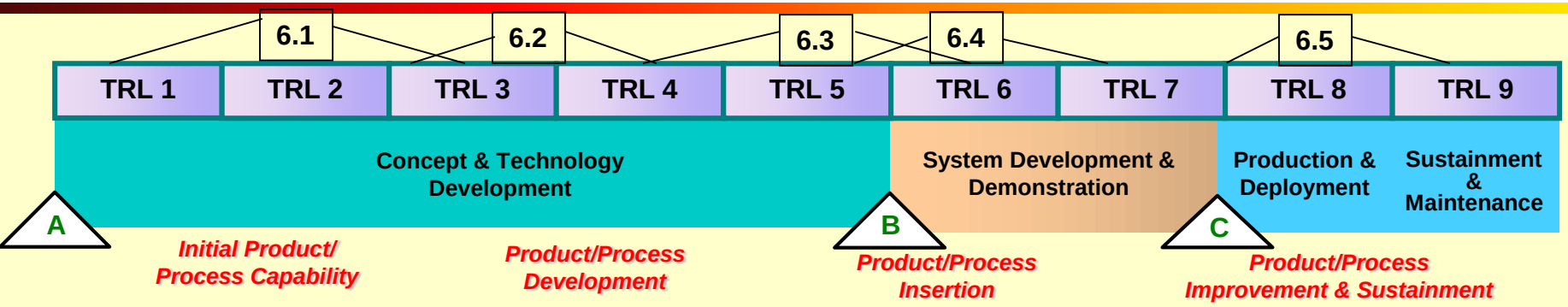
Raven UAV for small units from Pathfinder ACTD



Title III's Laser Protective Eyewear

AS&C Programs

Addressing Acquisition Lifecycle



Joint Warfighting Program (JWP)

ACTDs /JCTDs

Defense Acquisition Challenge

Foreign Comparative Testing

Independent Research & Development

Tech Link

Manufacturing Technology

Tech Transition Initiative

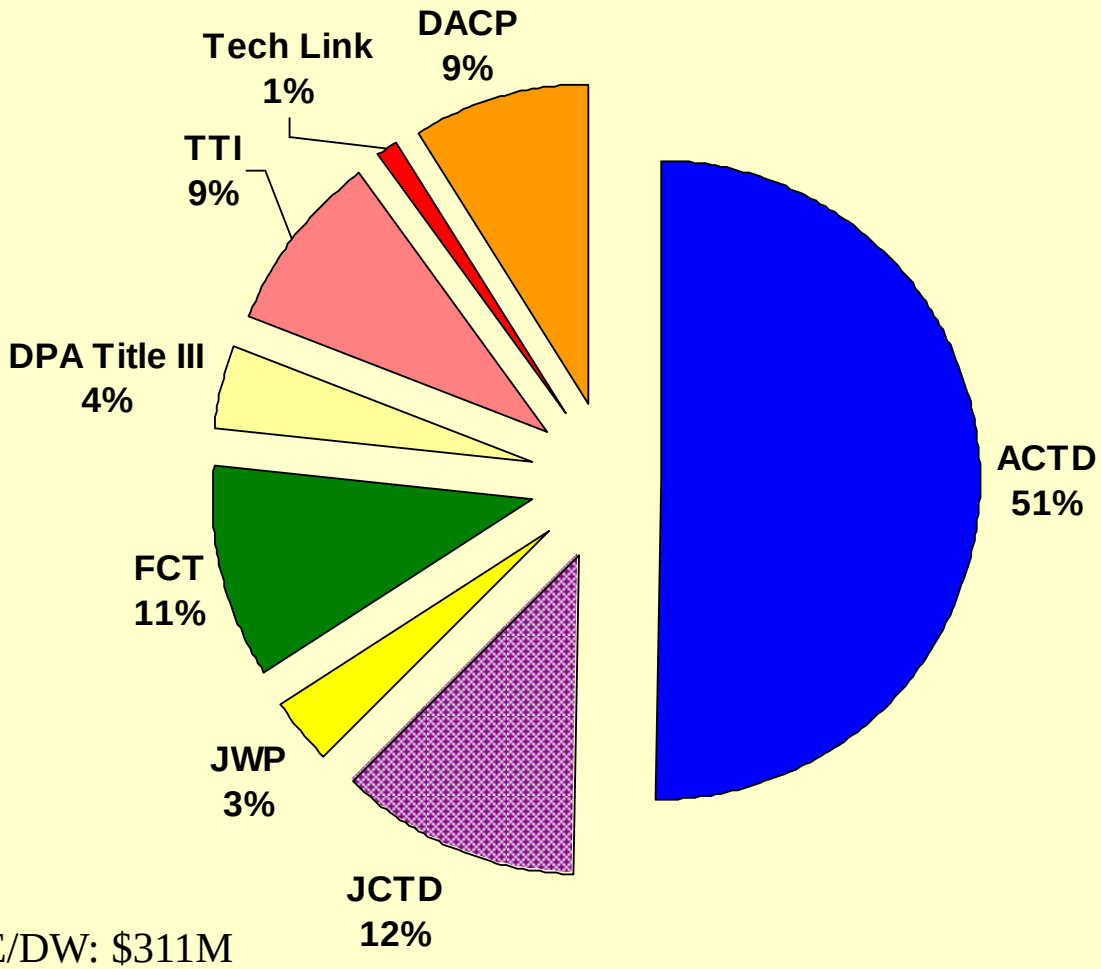
Title III of the Defense Production Act

Joint CoCom Customer

Service/Agency Customer

FY 2006 AS&C Resources Overview (Direct Oversight of $325M) as of Feb 2005

Source: FY 2006 President's Budget

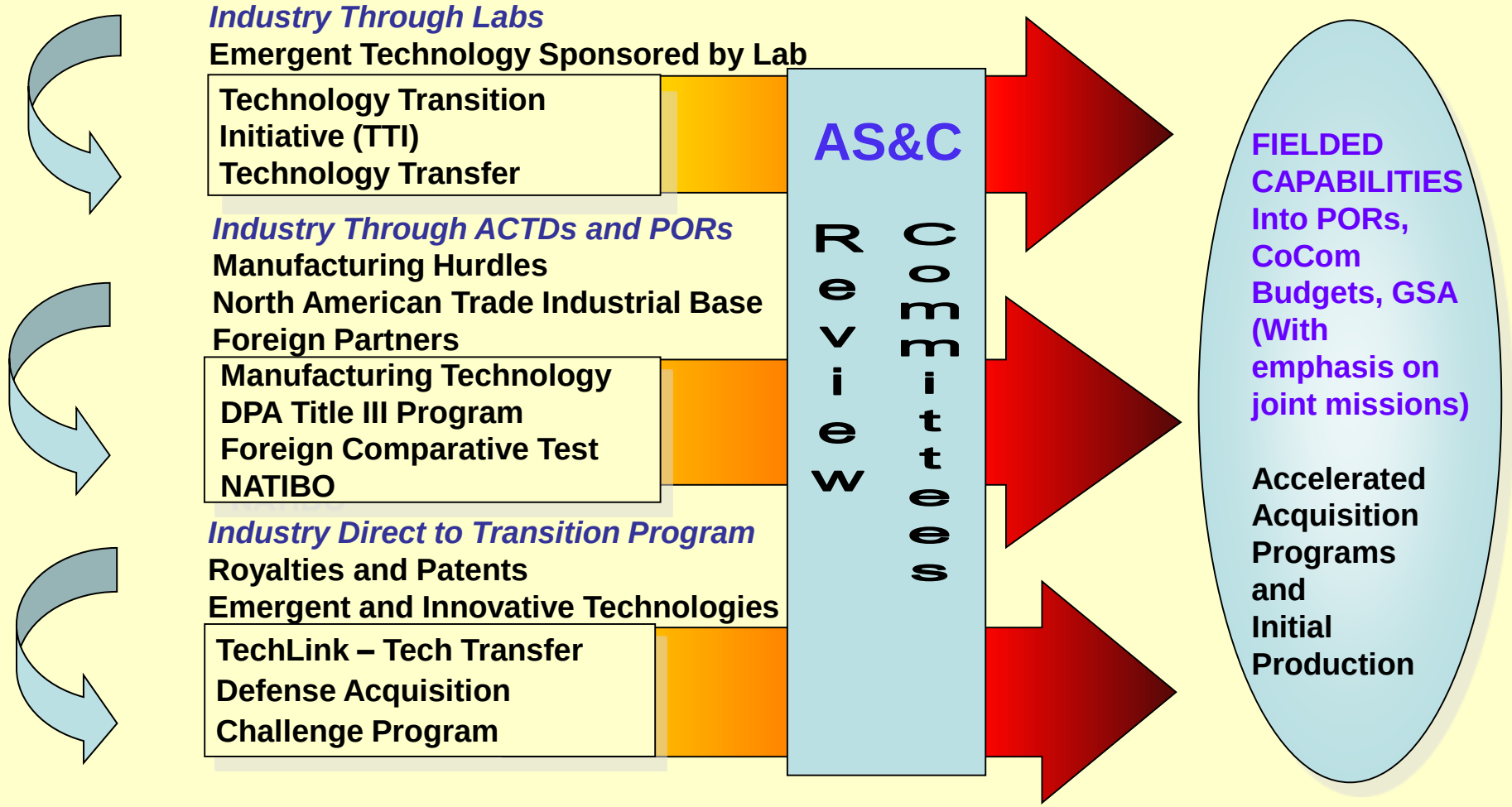


Program	$M
Advanced Concept Technology Demonstration (ACTD) (BA-3)	$164
Joint Capability Technology Demonstration (JCTD) (BA-3/4/5 & Procure)	$40
Joint Warfighting Program (JWP)-BA-3	$10
Foreign Comparative Testing (FCT)-BA-6	$36
Defense Production Act (DPA) Title III	$13
Technology Transition Initiative (TTI)-BA-3	$30
TechLink (BA-3)	$3
Defense Acquisition Challenge Pgm (DACP)-BA-5	$29

- RDT&E/DW: $311M
- DPA Title III Procurement: $13M
- OSD Maj Equip-JCTD Procure: $1M

AS&C Industry Opportunities

Technology transition programs can work in harmony or independently, but they all share a common goal—to accelerate the best technologies available to the warfighter into residual capabilities, acquisition programs, and ongoing sustainment.



AS&C Programs

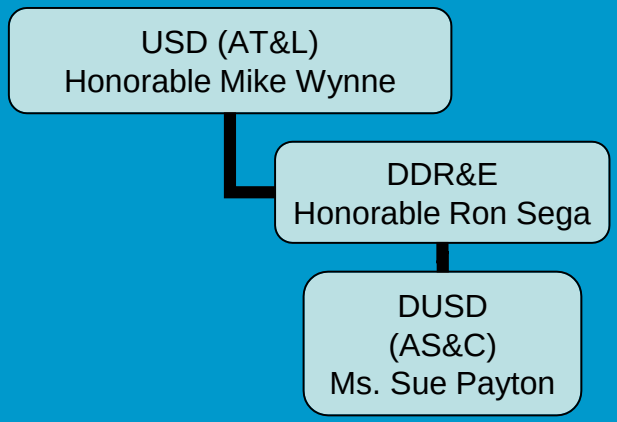
www.acq.osd.mil/asc

Program	Website	Phone
Advanced Concept Technology Demonstration (ACTD)	www.acq.osd.mil/actd	(703) 697 - 3568
DPA Title III	www.dtic.mil/dpatitle3	(703) 607 - 5314
Independent R & D	www.dtic.mil/ird	(703) 607 - 5314
Comparative Test Office	www.acq.osd.mil/cto	(703) 602 - 3740
Def Acquisition Challenge	https://bids.acqcenter.com/dacp	(703) 602 - 3739
Technology Transfer	www.dtic.mil/techtransit	(703) 607 - 5315
TechLink	www.techlinkcenter.org	(703) 607 - 5315
TechMatch	www.dodtechmatch.com	(703) 607 - 5315
NATIBO	www.dtic.mil/natibo	(703) 607 - 5315
Dual Use S&T	www.dtic.mil/dust	(703) 607 - 5315
Tech. Transition Initiative	www.acq.osd.mil/iti	(703) 607 - 5316
ManTech	www.dodmantech.com	(703) 607 - 5319

QUESTIONS?

Ms. Sue Payton
DUSD (AS&C)/Dep. DDR&E
(Acting)
April 20, 2005

Advanced Concept Technology Demonstration (ACTD)



Rapidly placing relevant, mature technology into the hands of Joint and Coalition Warfighters

FY 2005 ACTD Sponsored by NDIA

Actionable Situational Awareness Pull (ASAP)

UNCLASSIFIED

Mark Peterson

Head, Program Resources & Integration

Deputy Under Secretary of Defense

Advanced Systems & Concepts

www.acq.osd.mil/actd

National Defense Industrial Association (NDIA) Conference

April 19, 2005

Advanced Systems & Concepts

Rapidly Placing Relevant, Mature Technology into the Hands of Joint and Coalition Warfighters

DACP





Defense Acquisition Challenge Program (DACP): Aerogel for Ships: Fire barrier, IR Suppression, Blast Mitigation, Decreased Weight, Volume, Installation Costs, and Fuel Savings.

DPA Title III



Title III's Laser Protective Eyewear project established a domestic supplier for high performance infrared coatings for spectacles, goggles and visors.

DoD's Resource for Technology Transition

AS&C Partners with Services & Agencies to:

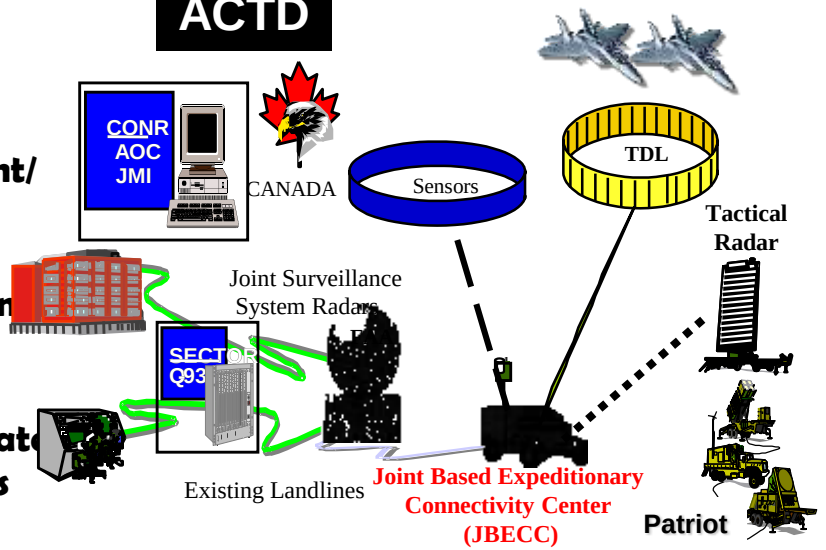
- **Match technology to warfighting needs– lab and industry outreach**
- **Overcome resistance to transformational concepts**
- **Ensure technology contributes to joint/ coalition capabilities**
- **Provide joint warfighters with option for integrating service capabilities**
- **Transfer DoD technology to the private sector: An industry on-ramp and access to meeting warfighter needs**

TTI



Technology Transition Initiative (TTI) used DARPA's **Water Purification Pen** technology to accelerate the technology fielding to Afghanistan, Iraq, and Tsunami Victims.

ACTD



Area Cruise Missile Defense (ACMD) ACTD integrates civilian and military sensors into a single air-defense common operational picture.

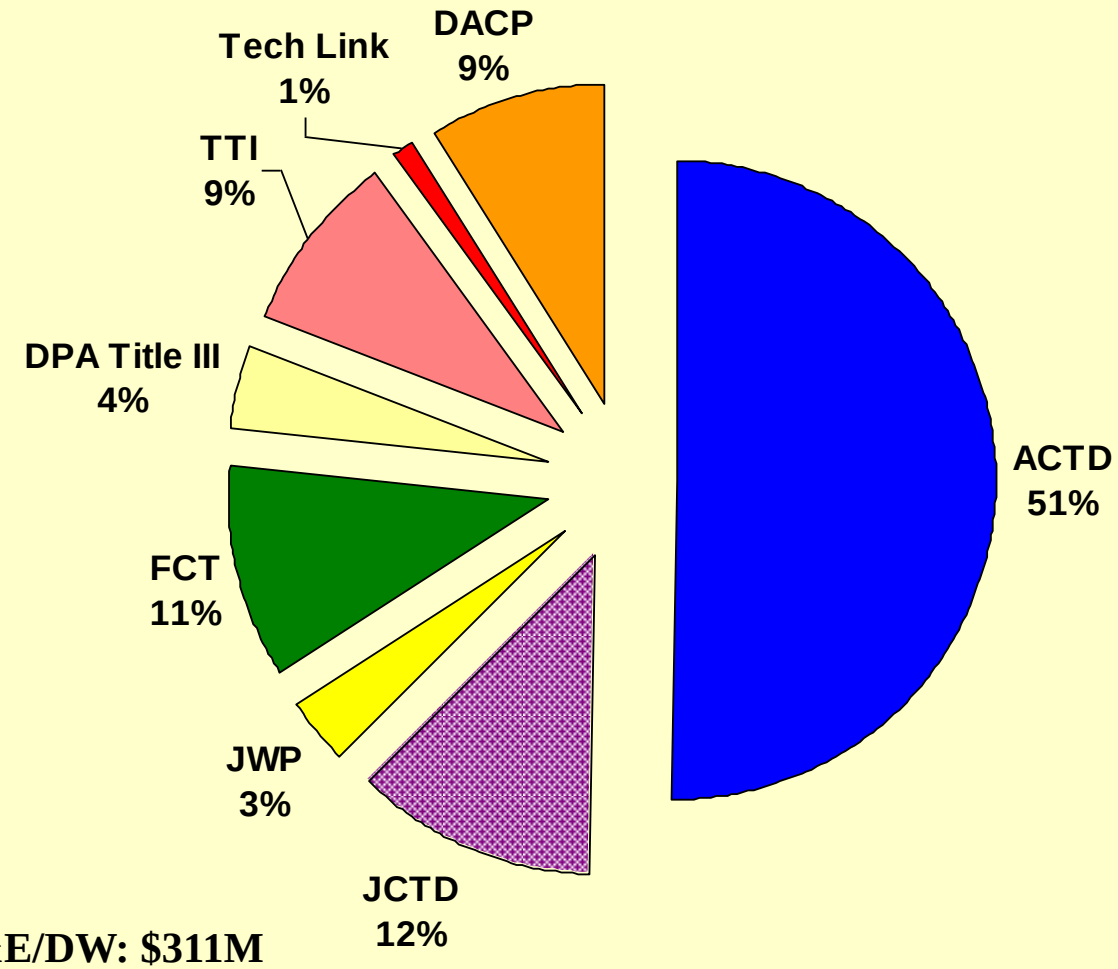
Video

ACTD Support to Joint Combatant Commanders

- **ACTDs rapidly field emergent mature technologies to joint warfighters**
  - Balanced emphasis on tailoring technology with associated Tactics, Techniques, & Procedures (TTPs) to user needs
- **Primary customers for ACTDs are joint Combatant Commanders**
  - Joint, Coalition, & transformational opportunities are priorities
  - ACTDs require a Lead Service/Agency and a CoCom Sponsor
- **ACTDs are not an acquisition/procurement program**
  - Charter is to minimize processes that delay rapid fielding of demonstrations
  - Overcoming resistance to transformational concepts
  - "Rack & Stack" voting process used to select Candidate slate inside the Planning, Programming, Budgeting & Execution (PPBE) process
    - Example: FY 2006 selection is in process now

FY 2006 AS&C Resources Overview (Direct Oversight of $325M) as of Feb 2005

Source: FY 2006 President's Budget



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NATIBO	www.dtic.mil/natibo	(703) 607 - 5315
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Tech. Transition Initiative	www.acq.osd.mil/iti	(703) 607 - 5316
ManTech	www.dodmantech.com	(703) 607 - 5319

FY 2006 RDT&E President's Budget Request

OSD Defense Wide Transition Programs Highly Leveraged across Service and Agency Budgets.
Less than half a percent of RDT&E supports AS&C programs

Components (All RDT&E)	$B
USA	9.73
USAF	22.61
USN	18.04
Def Agency & SOCOM	18.97

(BA6 + BA7 = $24.93B)

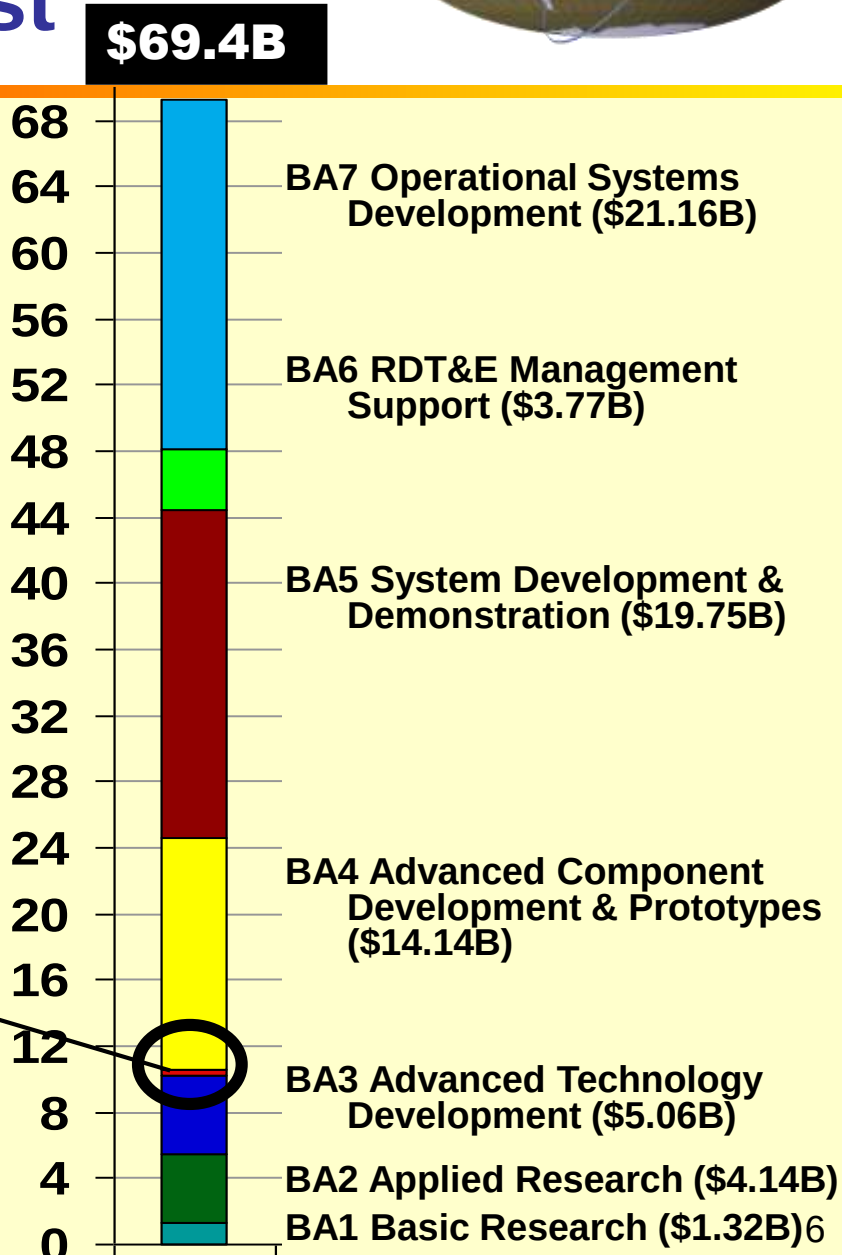
Development (BA4 + BA5 = $33.89B)

Defense Wide DUSD (AS&C) RDT&E Support Totals $311 M (~200 M from ACTD/JCTD BA-3)

Technology Base (BA1 + 2) = $5.46B)

Science and Technology (BA1 + BA2 + BA3 = $10.52B)

15% of RDT&E

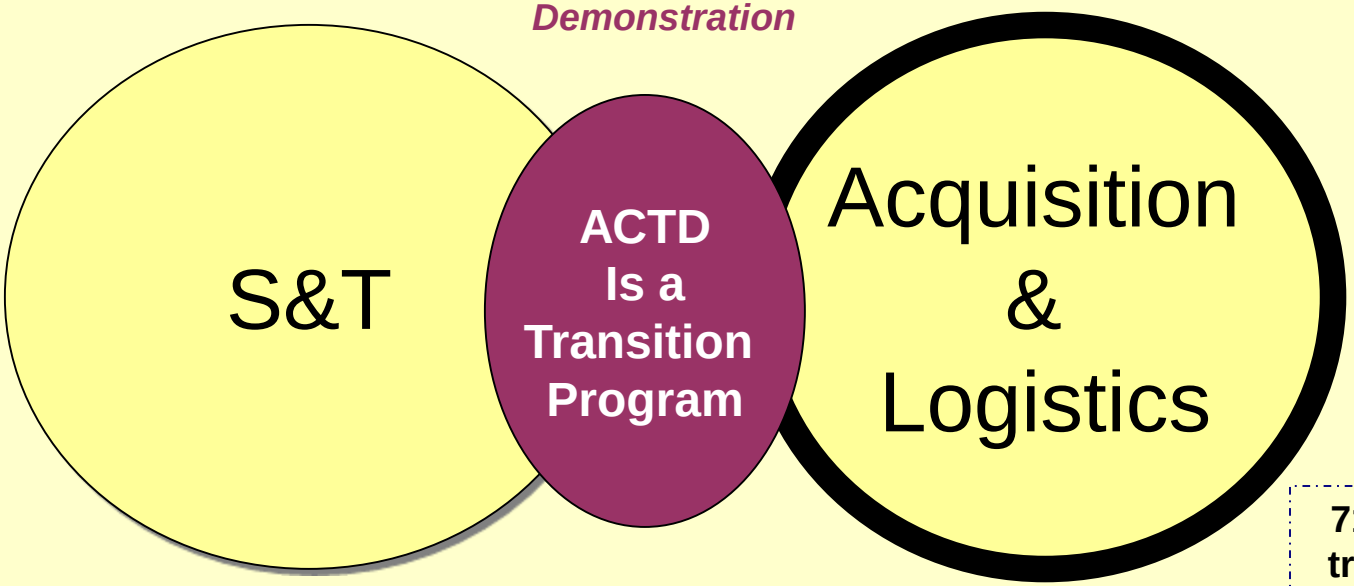


ACTD Projects Positioned between S&T & Acquisition

Filling the Gap between S&T and Acquisition for the CoCom Customer

Advanced Concept Technology Demonstration

"Try before you buy"



"The 80% Solution"

71% of all ACTDs transition at least one product into a warfighting capability

Transition programs are <u>not</u> acquisition programs, and should <u>not</u> be science projects

Resource Perspective:
Core Military Capabilities and Joint Enablers

Characterization of CoCom Needs:

- Core Service-specific capabilities (~80%?)

TTI, DACP, FCT Targets

☆ **Joint military capabilities (~20%?)**

ACTD/JCTD Target Area

Nature of CoCom Joint Needs:

- Interactive, Multi-Service core military capabilities

TTI, DACP, FCT Targets

☆ **Joint enabling capabilities**

ACTD/JCTD Target Area

☆ **Unique Regional/Specified mission needs**

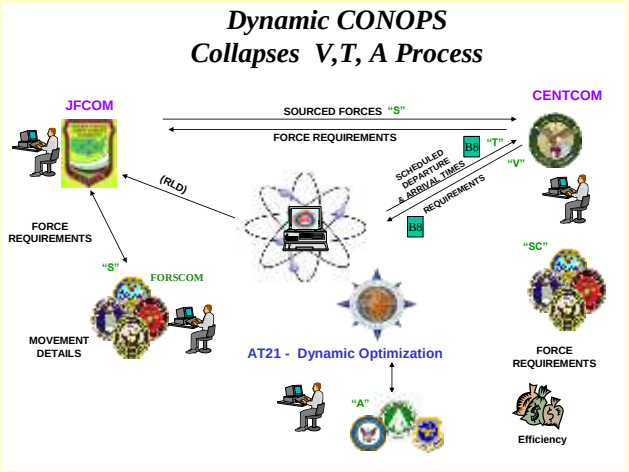
ACTD/JCTD Target Area

ACTD Examples & Highlights



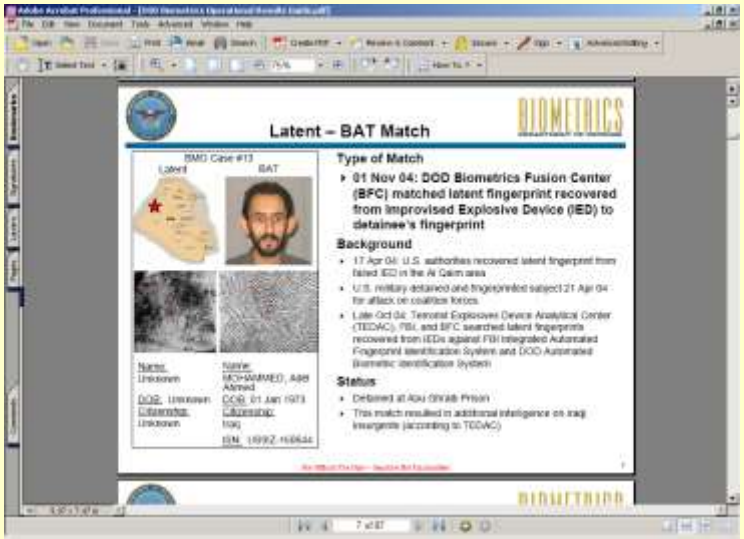
Theater Support Vessel

(2003-2006)



Agile Transportation for the 21st Century

(2002-2005)--Accelerated



Biometrics Automated Toolset
HUMINT and Counter-Intelligence Support Tools ACTD (1999-2003)

FY 2005 there are 79 Active ACTDs

ACTDs either:

- Transition to Program of Record,
- Residual Meets Need of Warfighter, or
- Return to Technology Base

Deliverables of an ACTD:

- Concept of Operations {to include Tactics, Techniques, and Procedures (TTP)}
- Military Utility Assessment (MUA)
- Residual Leave Behind



Spartan Scout

Midyear Start
(2002-2007)

Spartan Video



Active Denial System
(2002-2006)

ADS Video



Tactical Interferometric Synthetic Aperture Radar (TACT IFSAR ACTD)

(2003-Canceled 2005)



Joint Explosive Ordnance Disposal (JEOD) ACTD

(2002-2006)

COMPLETED ACTDs Deployed in Recent Conflicts

Updated Dec 2004







Completed ACTDs Used in Recent Conflicts	OAF	OEF	OIF	NE	O
➢ Adaptive Course of Action					X
➢ Advanced Joint Planning	X	X	X	X	
➢ Airbase/Port Biological Detection	X	X	X	X	
➢ Area Cruise Missile Defense				X	X
➢ Battlefield Awareness & Data Dissemination	X	X	X		
➢ Chemical Add-On to Biological Detection	X	X	X	X	
➢ Coastal Area Protection			X		X
➢ Coherent Analytical Computing Environment			X	X	
➢ Common Spectral MASINT Exploitation		X	X	X	X
➢ Consequence Management	X	X	X	X	X
➢ Counterproliferation I	X	X	X		
➢ Counterproliferation II	X	X	X		
➢ Counter Sniper					X
➢ C41 for Coalition Warfare		X	X		X
➢ Extending Littoral Battlespace/JTF WARNET		X			

Key
OAF - Operation Allied Force – Kosovo OEF - Operation Enduring Freedom – Afghanistan OIF - Operation Iraqi Freedom – Iraq NE - Noble Eagle – US Air Space O – Other Note: Other includes conflicts and operations like providing support to USFK, the Space Shuttle Columbia recovery operation and US Olympics

Dec 2004

COMPLETED ACTDs Deployed in Recent Conflicts







Completed ACTDs Used in Recent Conflicts	OAF	OEF	OIF	NE	O
➢ Global Monitoring of Space ISR Systems					X
➢ High Altitude Endurance UAV – Global Hawk		X	X		
➢ Human Intell & Counterintelligence Tool	X	X	X		
➢ Info Assurance: Auto Intrusion Det Environment	X	X	X	X	
➢ Integrated Collection Management		X	X		
➢ Joint Biological Remote Early Warning	X	X	X		
➢ Joint Combat Identification			X		
➢ Joint Logistics		X	X		
➢ Joint Medical Operations/Telemedicine			X		X
➢ Link-16	X	X	X	X	
➢ Medium Altitude Endurance UAV – Predator	X	X	X		
➢ Military Ops in Urban Terrain	X	X	X		
➢ Navigation Warfare	X				
➢ Precision/Rapid Counter-MRL					X
➢ Personnel Recovery Mission Software		X	X		
➢ Precision SIGINT Targeting	X	X	X		X
➢ Precision Targeting Identification		X	X		X
➢ Rapid Force Protection Initiative			X		
➢ Small Unit Logistics		X	X		
➢ Space Based Space Surveillance Operations		X	X		
➢ Theater Air & Missile Defense Interoperability					X
➢ Theater Precision Strike Operations		X	X		X
➢ Unattended Ground Sensors	X	X	X		

Dec 2004

ACTIVE ACTDs Deployed in Recent Conflicts



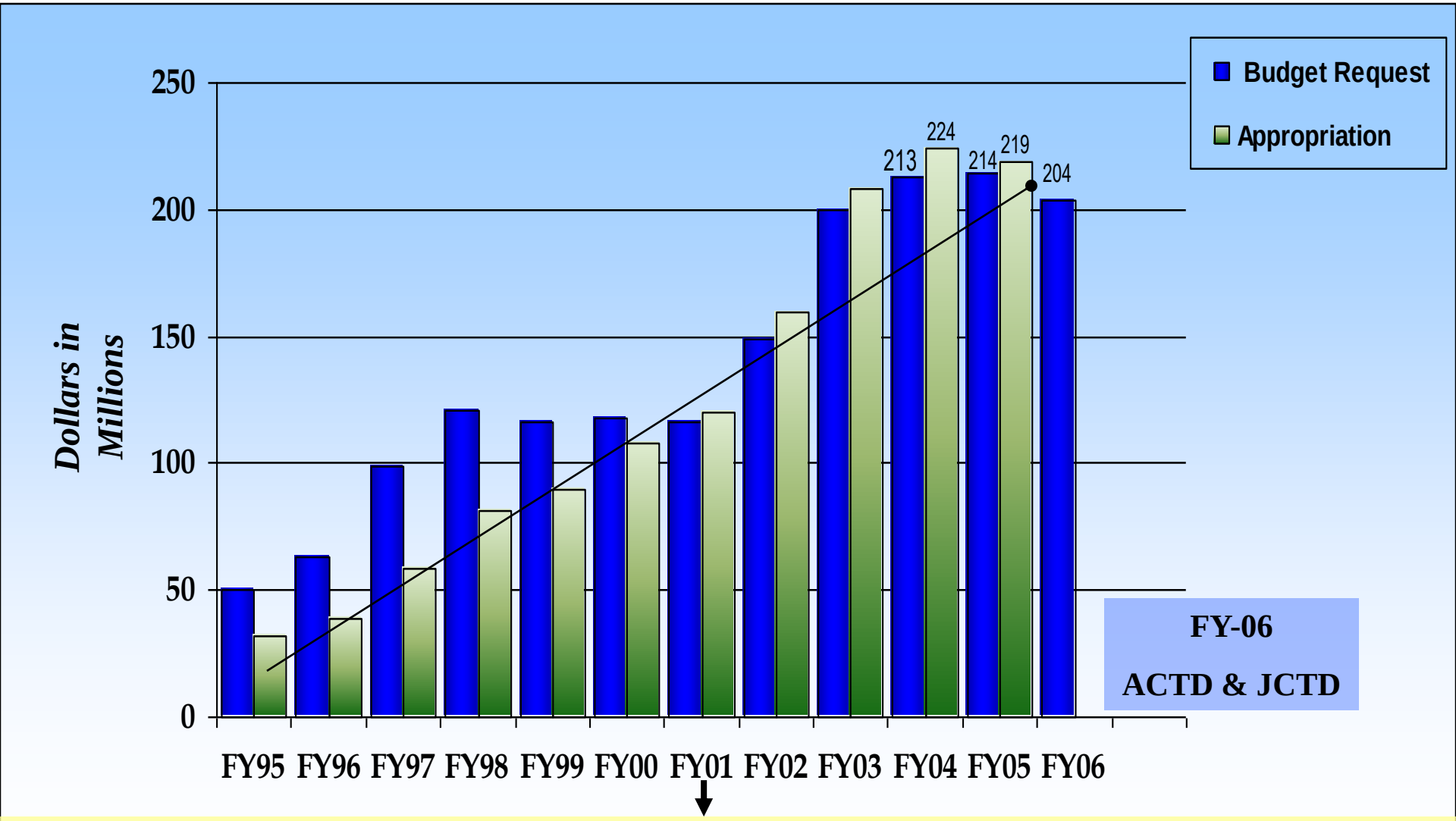




Active ACTDs Used in Recent Conflicts	OAF	OEF	OIF	NE	O
➢ Active Network Intrusion Defense					X
➢ Adaptive Battlespace Awareness			X		X
➢ Boundary Step			X		
➢ Coalition Theater Logistics		X	X		
➢ Comm/Navigation Outage Forecast System	X	X	X	X	X
➢ Computerized Operational MASINT Weather		X	X	X	
➢ Contamination Avoid at Seaports of Debarkation			X		
➢ Expendable Unmanned Aerial Vehicle		X	X		
➢ Ground-to-Air Passive Surveillance				X	
➢ Homeland Security Command & Control					X
➢ Joint Adv Health & Usage Monitoring System			X		
➢ Joint Area Clearance		X	X		
➢ Joint Distance Support & Response			X		
➢ Joint Explosive Ordnance Disposal		X	X		
➢ Joint Intelligence, Surveillance, and Reconnaissance			X		
➢ Language & Speech Exploitation Resources		X	X		
➢ Overwatch			X		
➢ Pathfinder		X	X		
➢ Personnel Recovery Extraction Survivability			X		
➢ Restoration of Operations			X		
➢ Spartan			X		
➢ SIGINT Processing			X		
➢Theater Support Vessel		X	X		
➢Thermobarics		X			

Dec 2004

ACTD Historical Funding Profile
Budget Vs. Appropriation



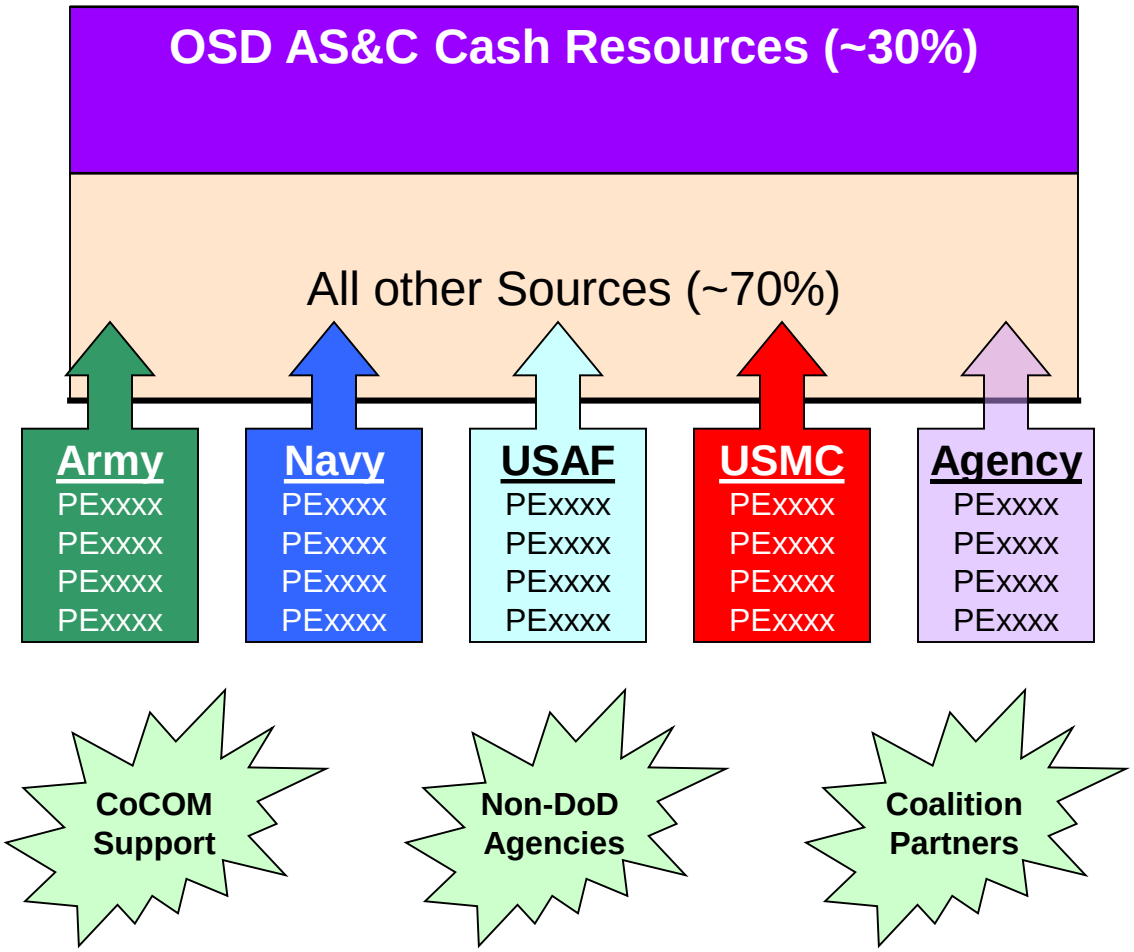
Starting in FY 2001 Congress fully supports ACTD Budget Request

Can the Current ACTD business process be improved? – Current Model

Challenges:

- **Front-end (start-up) and tail-end (transition) funding issues create serious PPBE challenges.**
- **Little incentive for Service participation as New ACTDs create immediate unfundeds.**
- **Significant start-up and demonstration delays after JROC decision: Avg 6 month delay waiting for Implementation Agreements.**
- **Many different Program Elements fund ACTDs (Little visibility at Service level—accountability challenges)**
- **Projects require sustained commitment of resources once initiated.**
- **Unfunded Requirements (UFRs) during execution cause significant risk and disruption as OSD tries to "share" the UFRs with stakeholders.**
- **Even successful demonstrations risk waiting 2 years (or more) for resources to be programmed via rigid PPBE process.**

Goal is to initiate ACTDs within months of a JROC approval. However, two year PPBE process creates Service challenge in funding new ACTDs.
(Difficult to achieve before the third year)



ACTD → JCTD

3-5 year transition

- Time is right to take the best parts of the ACTD program and initiate a new business model…the **Joint Capability Technology Demonstration (JCTD)**

- **JCTD developed based on:**
  - **GAO Audit (2002): Break traditional barriers to transition "joint" technologies**
  - **Defense Science Board (2003): Strengthen the CoCom influence**
  - **Joint Capability Study (2004 "Aldridge Study"): Better "joint" business models**
  - **Internal OSD direction (2004-2005):**
    - **SECDEF/CJCS: *"Joint has become the rule--is no longer an occasional luxury"* --- *"Rapidly changing environment and Global War on Terror (GWOT) has created the need to develop Joint capabilities more rapidly"***
    - **Enhance the ACTD program & provide better visibility of funding**
    - **Leverage the Joint Capabilities Integrated Development System (JCIDS process) to establish an improved process for transitioning ACTDs to acquisition programs**
  - **Congressional influence (2005) : Maintain focus on the acceleration of innovative, relevant capabilities to meet most critical warfighter needs**

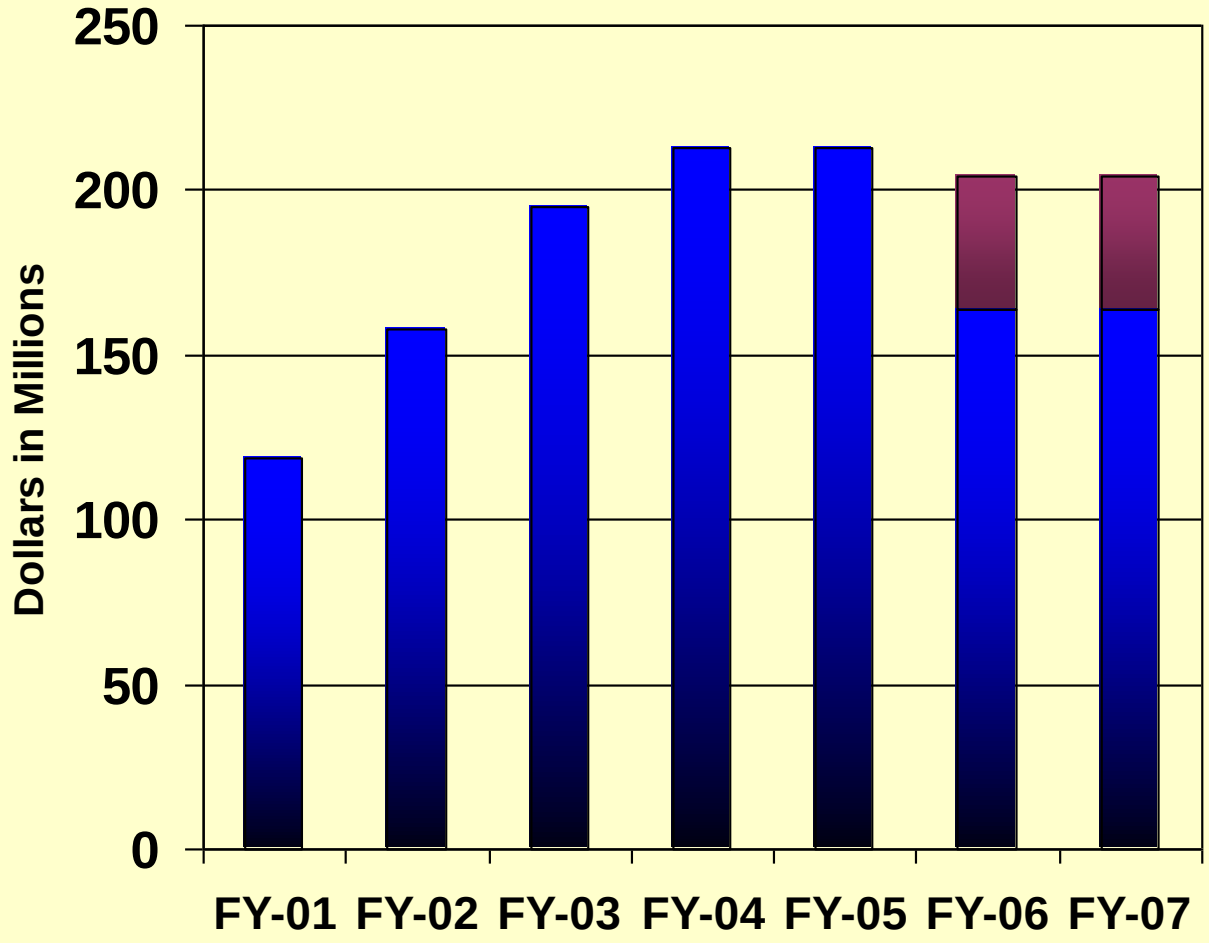
The JCTD program was initiated in the FY 2006 President's Budget

DUSD (AS&C) Direct Funding

ACTD & JCTD Programs

(Actuals & FY 2006 President's Budget)

As of February 2005



- JCTDs are resourced in RDT&E/DW (BA-3, BA-4, BA-5) and Procurement accounts

JCTD program initiated in FY 2006. Three to five year transition from ACTD to JCTD

JCTD/ACTD OSD Funding (FY 2006 President's Budget—$M)

OSD Shifts $40M from ACTD to JCTD to initiate the program

ACTD and JCTD Program Funding Summary	APN	BA	PE	**FY-04**	**FY-05**	**FY-06**	**FY-07**
Advanced Concept Technology Demonstration (ACTD)	RDT&E	3	0603750D8Z	**212.570**	**212.915**	**163.649**	**163.744**
Joint Capability Technology Demonstration (JCTD)	RDT&E	3	0603648D8Z			**35.000**	**35.000**
Joint Capability Technology Demonstration (JCTD)	RDT&E	4	0604648D8Z			**3.000**	**3.000**
Defense Acquisition Executive (JCTD Pilot Program)	RDT&E	5	0605648D8Z			**1.000**	**1.000**
Procurement (JCTD Pilot), Major Equipment-OSD Def Wide	Proc	1	0902198D8Z			**1.000**	**1.000**
Total JCTD:						**40.000**	**40.000**
Total ACTD and JCTD				**213**	**213**	**203**	**204**

Beginning in FY 2006, initiation of the JCTD process. 3-5 year transition period

New "Joint Capability Technology Demonstration" (JCTD) business process— *Proposed Funding Model*

JCTD Overview

Advanced Systems and Concepts

- First two years of Resources fenced by OSD – Held in OSD PE. Most compelling JCTDs will be resourced (incentive created)
- Year 3 (if necessary) funded by all stakeholders
- Transition Year funded by OSD— allow time for Services to POM for transition
- OSD can "afford more risk" protecting scarce resources.
- DARPA funds included in centralization model to cement partnership between development and transition
- Unfunded requirements easier to address without Service or Comptroller intensive reprogramming actions in year of execution
- New Model will provide clear visibility of total JCTD Cash budgeted and executed (OSD/C, Congressional & GAO concern)
- Defense Acquisition Executive (DAE) pilot program for selected JCTDs post BA-4.

FYDP Timeline (Based on 3 year Demo Phase)

1st & 2nd Year Funding	Year 3 Services Provide $$	Transition
	Spiral Technologies. Final demo all JCTDs in 3 years or less.	
OSD Provides at least 50% of the Resources during the first two years of the JCTD. JCTD PE 0603648D8Z	New Army JCTD PE New Navy JCTD PE New Air Force JCTD PE New Marine Corps JCTD PE New DARPA JCTD PE	OSD provides transition dollars for successful JCTDs (0604648D8Z)

DAE Pilot program

BA-5 (0605648D8Z)

OSD Maj Equip Procurement (0902198D8Z)

Agency

PExxxx
PExxxx
PExxxx
PExxxx

Non-DoD Agencies

Coalition Partners

CoCOM Support

Limited number of Selected "Joint Peculiar" JCTDs may enter the DAE Pilot program. Most JCTDs will Transition through normal processes.

ACTD-JCTD Wing Walk
Enhancing the Business Model for the Joint Customer

Combatant Commander remains the Primary Customer	
Advance Concept Technology Demonstration (ACTD)	**Joint Capability Technology Demonstration (JCTD)**
○ **Final Demonstration: 3-4 years**	• **Final Demonstration: 2 – 3 years with spiraled-out capabilities.** **Impact: Mature capabilities demonstrated to the joint warfighter faster.**
○ **Challenging ACTD selection process: CoCom near-term versus rigid PPBE 2 year resource process.**	• **Greater CoCom Focus through JCTD Selection Process:** Stakeholders have decision in resource allocation for funds already set-aside. **Impact: JCTDs maintain relevancy/purposely resourced for success.**
○ **OSD provides limited funds: Services required to "break" programs to fund new capabilities.**	•**JCTD Resources (Quick Start):** OSD provides majority Service funding for the first two years of the JCTD. **Impact: Accelerate JCTD initiation and increase funding stability.**
○ **Difficult to track ACTD funding in Service lines (multiple Program Elements).**	• **JCTD-specific Program Elements Created**. **Impact: Increase funding accountability and tracking. Provides time for Services to POM for selected JCTDs.**
○ **ACTDs face difficult Transition challenges, creating "joint & coalition orphans."**	• **JCTD Transition stability: Funding across the Acquisition process. DAE pilot program** **Impact: Prevents delays and provides a strong advocate**

Performance Metric Comparison
ACTD vs. JCTD

Performance Metric	ACTD	JCTD
Project Selection Focus	Threat Based: Shared Military Service and CoCom influence	Capability Based: Greater CoCom influence looking at nearer term **joint/coalition** needs..
Spiral Technologies	No Metric currently established	Spiral Technology available within **one year** of JCTD initiation.
Final Demonstration Completed (Starting Point: Approved ID)	3 to 4 years after initiation (Implementation Directive (ID) Signed)	50% completed by the end of the 2nd year. All JCTDs completed by the end of the 3rd year.
Shared Funding and Visibility of resources	OSD provides no more than 30% of the budgeted resources. Funding provided from many different program elements.	OSD provide significantly more funding (more than 50% depending on cost of the JCTD), especially in the first two years.
Military Utility Assessment (MUA) conducted by an independent activity	MUA traditionally tied to a specific planned exercise for evaluation	JCTDs not necessarily tied to an exercise. Greater flexibility to establish military utility via operational "real-world" demonstration or specifically designed test/venue
Transition of technology	70% of ACTDs transition at least one product to sustainment	80% of JCTDs transition at least 50% of their products to sustainment

Source: FY 2006 President's Budget

Why Evolve ACTDs To JCTDs Now?

- **"It's the right thing to do": (ADM Fargo, USPACOM)**
  - **CoCom customers need an early voice in needs process that responds quickly.**
  - **AT&L can provide a compelling joint approach as an answer to:**
    - Starting fast (inside the PPBE process).
    - Prevents breaking Service programs at the start of each ACTD.
    - Addresses the "Valley of Death" between successful demonstrated capabilities & transition to acquisition/sustainment.
    - GAO, Congressional, DSB, and other studies which support the philosophy of the JCTD initiative.

- **The time is right:**
  - JCTD fits the transformation and GWOT initiatives of the Department
  - Directly supports the SECDEF's goals of shifting to a more rapid, joint capability process that will increase CoCom influence.

ACTD/JCTD Back-up Slides and Questions

"Finally, I will add that **we are encouraged by recent actions** taken by DOD to initiate a **joint concept technology demonstration business process** **as it is intended to meet joint and coalition forces needs** and promotes many of the good practices we outlined above. To be successful, this process must have the authority and clout to overcome traditional barriers and the tools necessary to drive a knowledge-based, evolutionary acquisition approach."

GAO Testimony before the HASC Subcommittee on Tactical Air & Land Forces by Michael Sullivan, Acting Director, Acquisition and Sourcing Management **(March 2005)**

Overview

Joint Capability Technology Demonstration (JCTD)
(Four parts to the 3-5 year initiative to transform the ACTD program to JCTD)

1. **Front-end incentive funds** create fair-share partnership. First two years of Service resources fenced in OSD. (JCTD PE will eventually replace ACTD PE)

   - **Incentive to participate without breaking Service core programs. Also provides stability of funding. The Best JCTDs "win" the resources.**

2. **Creation of new JCTD specific Program Elements (Defense Wide and Service)** (New D/W JCTD PE's have been created RDT&E BA-3/4/5)

   - **Visibility and Accountability of funds**
   - **Allows time for Services to POM for outyears as JCTD proves successful**

3. **One year of Transition funding** (New OSD JCTD PE in RDT&E BA-4)
   - **Bridge the S&T capability "Valley of Death" – DoD prepared to "catch" successful capabilities without destructive delays**

4. **Defense Acquisition Executive (DAE) Pilot program** – Transition "Joint Peculiar" systems into a fielded capability (New OSD PEs: RDT&E BA-5, OSD Procurement). Lays the groundwork for USD (AT&L) to pilot new acquisition models and look at ways to address joint challenges identified in the Joint Capability Study ("Aldridge Study").

   - **Tracking joint capability through acquisition into initial sustainment**

Resources were shifted from the ACTD program to initiate the JCTD business model

Quotes on Joint Needs

"The ability of the armed services – the Army, the Navy, the Air Force, the Marine Corps and the Coast Guard – to work together is increasing. It has to increase. Jointness has to become the rule and not an occasional luxury."

Secretary of Defense
Speech at the Association of the U.S. Army Annual Meeting, Phoenix, Oct. 27, 2004

"The rapidly changing international environment and the global war on terrorism require that we create joint capabilities more quickly."

General Myers, CJCS
(Joint Force Quarterly: Summer 2002)

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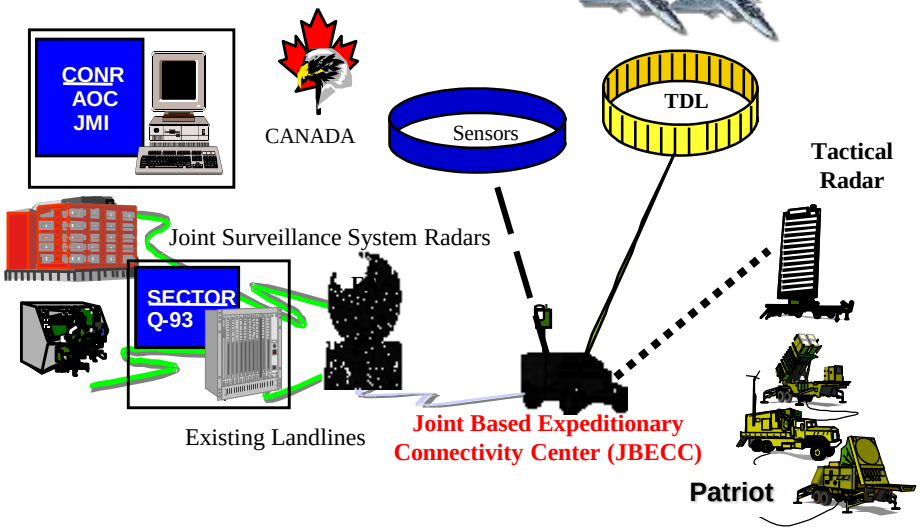
ADM Fargo (USPACOM)

"I'm writing in support of the AT&L JCTD initiative, which evolves the Advanced Concept Technology Demonstration Program and intends to stabilize start-up and transition funding for rapid development of Joint capabilities….We need a stable program that rapidly provides new Joint capabilities for demonstration, assessment, and operational use. The ACTD program has served us well. The JCTD initiative to stabilize funding and aid transition of new Joint capabilities, with minimal impact on Service programs, **is the right thing to do."**

Area Cruise Missile Defense (ACMD)

FY 2001 ACTD (Completed)

Problem: The continental US & North America lacks a robust capability to detect, track, and engage low altitude, low visibility cruise missiles, UAVs, and light aircraft. Current air defenses are 'perimeter-ized' and lack connectivity to various data sources and sensors.



Solution:

- Mobile Connectivity shelter (JBECC)
- Correlation Engines to process disparate data
- Comm Link into existing C4I networks
- Augment NORAD Air Defense
- Provide early detection of unidentified air tracks
- Connectivity to NORAD through tactical data links
- Link FAA, NORAD and 1st AF air defense forces

Benefits:

- Extensively used in Op Noble Eagle and Clear Skies
- Remains employed for National Capital Region air protection
- Employed for all Presidential CONUS travel
- Supported the 2004 G8 Summit and Republican National Convention
- Primary capability for Air Force Reserve/Air National Guard combat air defense patrols in CONUS
- Transitioned to 1st AF and ANG. USAF procuring 14 JBECC systems under the Joint Battle Center System Mobile program of record.

Expendable Unmanned Aerial Vehicle (EUAV)

FY 2002 ACTD

Problem: Lack of low cost, expendable tactical surveillance and payload dispensing capabilities for counter-drug and other operations.



Solution: Tactical surveillance, payloads, and payload dispensing technologies on low-cost, all-weather autonomously guided, expendable/recoverable unmanned vehicles.

Benefits:

- Much lower cost (75% less) than tactical UAVs
- Permits ready field access to ISR info when higher fidelity systems unavailable or not cost effective to risk their loss
- Employed extensively in OIF and OEF
- TERN and MAKO UAVs transitioned to SOCOM

ACTD – Small Business Success Stories
Expendable Unmanned Aerial Vehicle



XPV-1 Tern and MAKO UAVs Employed Successfully in Operations Enduring and Iraqi Freedom

- **NAVMAR Applied Science (Jessup, MD)**
  - **UAVs and air-delivered sensors**
  - **$9.3M, with potential $10M follow-on**
- **Phoenix Worldwide Industries (Miami, FL)**
  - **Air-delivered sensors**
  - **$1.5M, with potential $2M follow-on**
- **Cloud Cap Technology (Hood River, OR)**
  - **Autopilot systems**
  - **$100K, with potential $200K follow-on**
- **Advanced Ceramic Research (Tucson, AZ)**
  - **Advanced composite UAVs**
  - **$300K, with potential $500K follow-on**
- **COMPASS Systems (Patuxent River, MD)**
  - **Ground stations, software integration**
  - **$1.1M, with potential $2M follow-on**
- **Five other small businesses participating**

Theater Support Vessel (TSV)

FY 2003 ACTD









Problem This Solves: Need for a joint expeditionary capability to deliver combat ready units configured for immediate employment in JOA.

- High Speed Rapid Littoral Maneuver and Force Closure
- Rapid Unassisted Ingress and Egress Enables Austere Port Operations
- Reduction of Reception and Staging Times in Theater of Operations
- Mitigate Anti-Access and Area Denial Efforts

Solution:

- High Speed Vessel Capable of:
  - Intra-Theater Movement of Combat Ready Units
  - Ship-to-Ship and Ship-to-Shore Operations
  - Supporting Operations in the Littorals

Participants:

OM: CENTCOM, CASCOM (Deputy)
TM/XM: PEO CS&CSS, PM Force Projection,
PM Army Watercraft Systems
Independent Assessor: AEC
Sponsor(s): US Army

Schedule:

Independent Assessments/
LUAs – 2QFY04 - 4QFY05
MUA – 4QFY05

Status:

- OEF/OIF/Joint Military Exercises Support
  - Sailed over 80,000 NM, delivering 1.385 troops and 7,445 cargo tons
  - FY05 – RSOI/Foal Eagle, Cobra Gold, Talisman Sabre, Bright Star 05
  - Self-Protection Demo
- Program of Record in the Joint HSV Program Office
  - Continuing to spiral operational products
- C4ISR Upgrades – Battle Command Center/EMPRs
- Scalable Self Protection System

April 2005

Tactical Interferometric Synthetic Aperture Radar (IFSAR) Mapping

FY 2003 ACTD (Cancelled)

Problem(s): U.S. Forces do not have the capability to rapidly collect High-Resolution Terrain Information (HRTI) and produce wide area high-resolution digital elevation models on short notice.

Proposed Solution(s): The IFSAR Mapping ACTD would demonstrate a capability to rapidly collect and generate high-resolution terrain information (HRTI) data from a mid-altitude unmanned aerial vehicle (UAV).



Status: **ACTD cancelled** *due to excessive cost growth and programmatic risk.*
Could not gain access to Global Hawk (environmentally controlled payload bay), so design was re-targeted to Predator B (payload bay NOT environmentally controlled).
Increase in scope to modify radar design coupled with programmatic delays resulting from difficulty in obtaining commitment for any UAV platform caused excessive cost growth and risk.

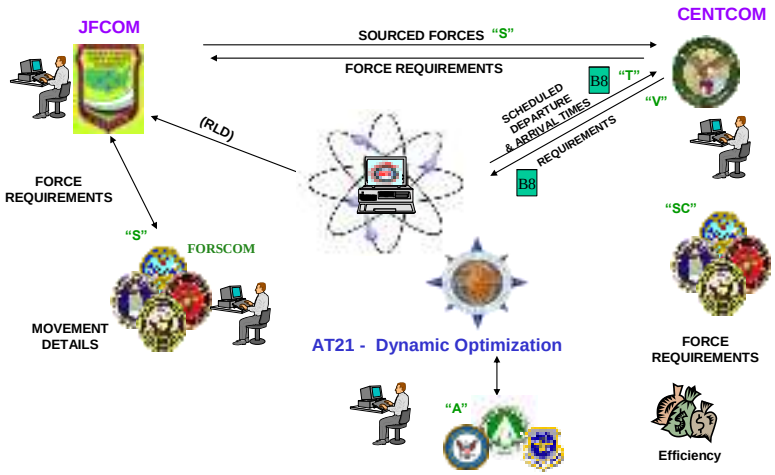
Status con't: Currently reviewing options using remaining funds to assess what portion of USSOUTHCOM's immediate needs can be met.

Agile Transportation for 21st Century (AT)

FY 2002 ACTD

Problem: The DTS has stovepipe processes for managing movement requirements, lift asset availability, and execution planning in separate environments and no capability to match global movement requirements against available lift assets to produce an optimized transportation schedule that meets warfighter delivery requirements.

Dynamic CONOPS Collapses V,T, A Process



Solution: Insert COTS technologies, automate and streamline business processes, and utilize commercial best practices for supply chain management.

Benefits:

- Improve Force Projection and customer confidence
- Optimize and analyze strategic/operational movement requirements
- Determine proposed mode selection, consolidations and routings
- Maximize asset utilization and cost avoidance

What are Joint Capabilities?

AS&C Program Perspective

Multi-Service Core Military Capabilities.

Common denominator Military forces provided worldwide as self-integrated, self-sustaining echelons by the Services.

(Global Positioning System, Movement Tracking System)

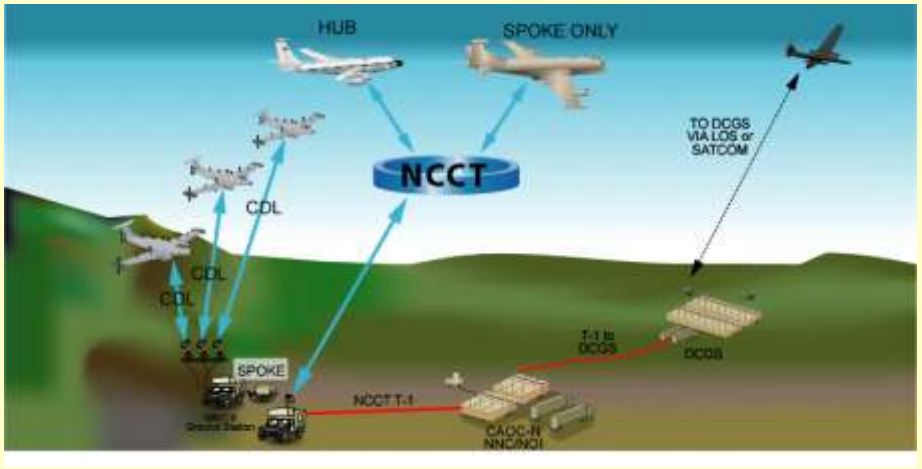
Joint Enabling Capabilities.

Additional capabilities required by warfighters to exercise joint command, and to enable core military elements to function effectively as a coherent joint force.

(Network Centric Operations, Common Operational Picture)

Joint is an inter-Service reliance acting together as one - not a patchwork of deconflicted Service operations.

(General Tommy Franks, excerpts from *American Soldier)*



Unique Regional/Specified Mission Requirements.

Capabilities beyond common core military capabilities required by warfighters to effectively function in operational environments associated with assigned regional or specified missions.

(Foliage Penetrating Radar, Language Translators)

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Research and Technology Needs

Focus on:
Force Protection
Combating Terrorism
Surveillance Technology

"Countering the Terrorist Kill Chain"

Mr. Ben Riley

ADUSD (Force Protection)

Chairman,

Combating Terrorism Technology Task Force (CTTTF)

April 19, 2005

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Overview

- **Combating Terrorism Technology Task Force (CTTTF)**
- Prior Years' Efforts
- CTTTF Outreach & Interaction with Joint IED Defeat Task Force
- Current Year Efforts
- Challenges

Overview

- Combating Terrorism Technology Task Force (CTTTF)
- **Prior Years' Efforts**
- CTTTF Outreach & Interaction with Joint IED Defeat Task Force
- Current Year Efforts
- Challenges

CTTTF Project Funding Summary

Deputy Secretary of Defense

- **Phase 1 Key Deliverables**
  - Accelerated Thermobaric Weapon
  - Nuclear Quadrupole Resonance
  - Conventional Air Launched Cruise Missile
  - LOGIR
  - Backscatter X-Ray Van
- **Funding**
  - DERF – FY01: $181M
  - DERF – FY02: $212M
- **Recipients**
  - Army
  - Navy
  - DTRA
  - TSWG

- **Phase 2 Key Deliverables**
  - Passive Attack Weapon
  - Crash Prompt Agent Defeat
  - Thermobaric Hellfire
  - Lightweight Sensor Package for Dragon Eye UAV
  - Massive Ordnance Air Blast
  - Water Purification Pen
- **Funding**
  - Quick Reaction Special Projects: $78M

National Counterterrorism / Counterinsurgency Integrated Test & Evaluation Center

Deputy Secretary of Defense

- Located at Yuma Proving Ground
- Purpose of Center is to test & evaluate capabilities beyond detecting & defeating IEDs
  - To include enhancements for testing of other counterterrorism and counterinsurgency technologies
- Evaluate technical performance and utility of prototype systems in a tactically significant environment, against representative threats
- Provide recommendations on deployment & follow-on production of prototype systems



Overview

- Combating Terrorism Technology Task Force (CTTTF)
- Prior Years' Efforts
- **CTTTF Outreach & Interaction with Joint IED Defeat Task Force**
- Current Year Efforts
- Challenges

Program Overview
CTTTF S&T Resources

Deputy Secretary of Defense

- Defense Advanced research Projects Agency (DARPA)
- Naval Research Laboratory (NRL)
- Office of Naval Research (ONR)
- Army Research Laboratory (ARL)
- Air Force Research Laboratory (AFRL)
- Army Night Vision Laboratory (NVL)
- Army Cold Regions Research & Engineering Laboratory (CRREL)
- Los Alamos National Laboratory
- Sandia National Laboratory
- Pacific Northwest National Laboratory (PNNL)
- Lawrence Livermore National Laboratory
- Massachusetts Institute of Technology – Lincoln Laboratory (MIT-LL)
- National Reconnaissance Office (NRO)
- National Security Agency (NSA)
- Defense Intelligence Agency (DIA)
- Defense Threat Reduction Agency (DTRA)
- Department of Energy
- Department of Homeland Security
- Department of State
- Central Intelligence Agency
- Federal Bureau of Investigations
- Space & Naval Warfare Systems Command (SPAWAR)
- Electronic Systems Command (ESC)
- Army Communications Electronics Command (CECOM)
- Army Soldier and Biological Chemical Command (SBCOM)
- Joint Information Operations Center (JIOC)
- National Geospatial Intelligence Agency (NGA)
- Joint Warfare Analysis Center (JWAC)
- Special Operations Command (SOCOM)

Overview

- Combating Terrorism Technology Task Force (CTTTF)
- Prior Years' Efforts
- CTTTF Outreach & Interaction with Joint IED Defeat Task Force
- **Current Year Efforts**
- Challenges

Critical "Kill Chain" Steps
CTTTF Areas of Investment

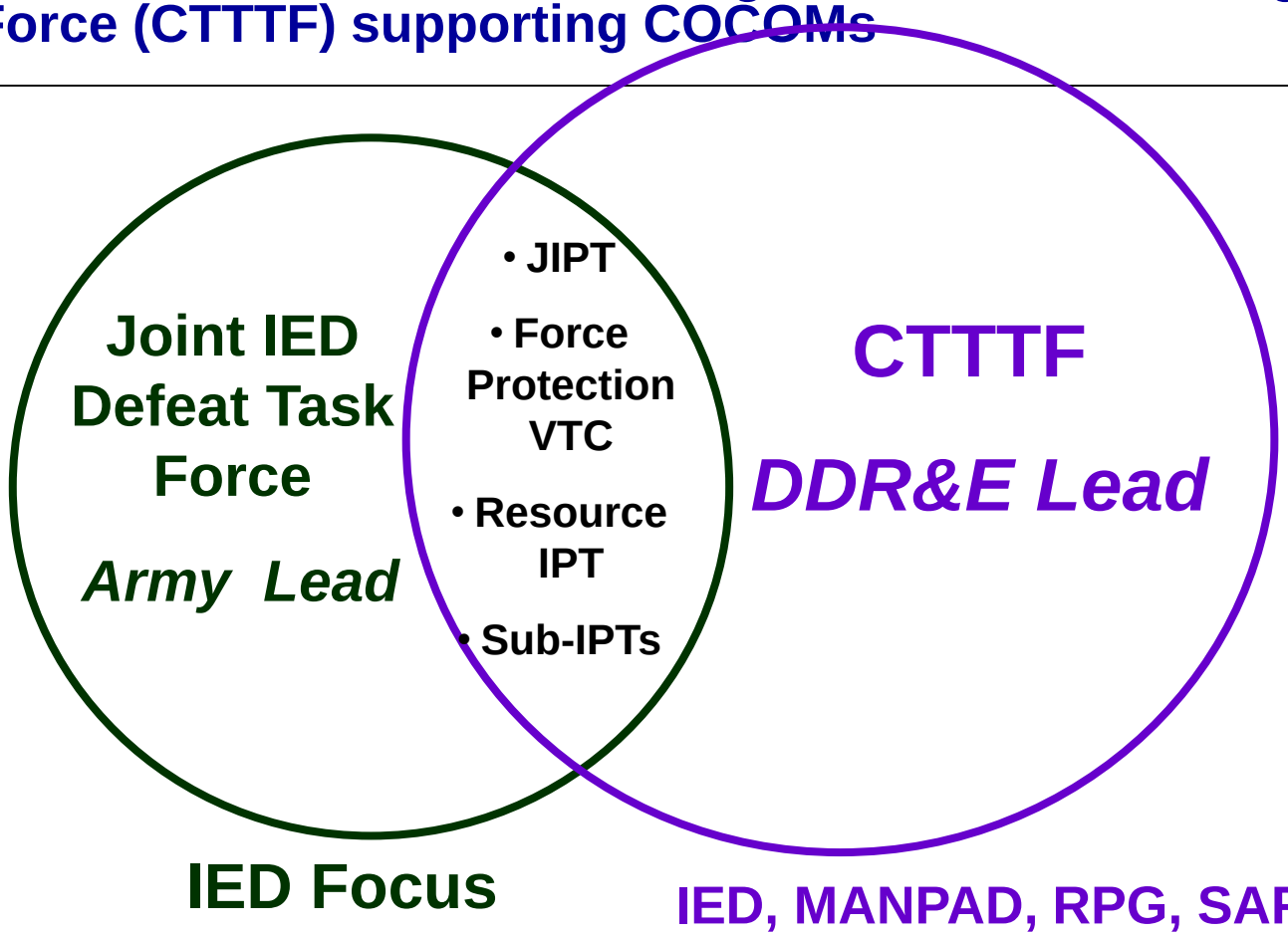
Deputy Secretary of Defense

- Intelligence capability enhancements
- Surveillance and reconnaissance
- Tagging, tracking and locating
- Communications and information sharing
- Deterrence/Dissuasion/Information Operations
- Identification
- Detection
- Defeat
- Crisis Management Capability – Mass Kidnappings
- Interagency/coalition coordination

Interaction of Joint IED Defeat Task Force and CTTTF

Deputy Secretary of Defense

- Joint IED Task Force and Combating Terrorism Technology Task Force (CTTTF) supporting COCOMs



Overview

- Combating Terrorism Technology Task Force (CTTTF)
- Prior Years' Efforts
- CTTTF Outreach & Interaction with Joint IED Defeat Task Force
- Current Year Efforts
- **Challenges**

Challenges

- **Accelerate the transition of technologies for counter insurgency / combating terrorism**
  - Defeat IED/VBIEDs, with an eye toward next threats
  - Consider IEDs within the context of counter insurgency operations
- **Exploit DoD, OGA, industry, & private sector technology bases to pre-empt an adaptive adversary**
  - Increasing reliance on intelligence sharing
  - Prototyping must be able to operate inside the adaptive adversary's OODA loop

More Challenges

- **Rapid prototyping requires close coordination between developer, tester, trainer, end-user, and sustainer**
  - **End-user acceptance of prototypes in field condition varies**
  - **Deployment and sustainment of proven technologies remains the long pole in the tent**

Summary

- **CTTTF leads the identification of mature technologies to address counter-insurgency / combating terrorism needs**
  - Weekly VTC
    - Communicate needs
    - Discuss technological solutions
    - Suggest alternate sourcing for mature technologies (JRAC)
    - Test status update on ongoing technology development
  - Small Group Review
    - Vet proposed technology solutions
  - Rapid Reaction/New Solutions
    - Fund late-stage RDT&E
    - Devote resources to test center upgrades
    - Fund prototypes for in-theater evaluation
  - CTTTF Supports Deployment
    - More difficult: Initial acceptance in field, follow on procurement, development of architecture

Planned & Ongoing FY05 Projects

- **IED Threat Detection**
  - RF Phenomenology
  - JSTARS GMTI enhancements (AF)
  - Laser Induced Breakdown Spectroscopy (ARL)
  - Vigilant Eagle
  - FOPEN
  - RF Emissions
  - Standoff Detection using Raman Technology
  - Limit
- **Info Analysis & Fusion**
  - Voice Authentication (Biometrics Management Office)
  - Biometrics field capability
- **IED Threat Defeat**
  - Compass Call enhancements
  - Disabling Captured Enemy Ammunition and Unexploded Ordnance
  - Scorpion
  - METRO
- **Intelligence**
  - Counter Insurgency Pattern Assessment R&D plus Augmented Reality
  - Electronic Personal Market Survey
  - Spoke
  - Project Intent
  - Predictive Technical Preparation of the Battlespace

Planned & Ongoing FY05 Projects

- **Surveillance & Reconnaissance**
  - Sonoma
  - Smart Dust (SOCOM)
  - SIGINT TVO (NRO/NSA)
  - CT/CBRN Tool (SOCOM)
  - Adv Optical Exploitation
  - Video tracking
  - Buried Cache & Target Detection
  - WATCH IT
  - Video Exploitation (DARPA)
  - Video Exploitation of PTDS (LLNL)
  - Border Surveillance Capabilities
  - Tagging, Tracking and Location Video Exploitation (Point Mugu)
  - Detection of Unintended Emissions (MIT/LL)
  - Wire Detection – MIT(LL)/JASONS Phase I
  - Cube Antenna (DIA)
- **Fielding, CONOPS, Support**
  - Yuma Proving Grounds – Sustainment plus improvement
- **Other**
  - Volumetrically Controlled Manufacturing for IED Armor
  - Master Maritime
- **Communications / Info Dissemination**
  - Asymmetric Data Retrieval
  - Optical communications link (NRL & SOCOM)
  - WIMAX

Test and Evaluation/ Science and Technology (T&E/S&T) Program

6th Annual Science & Engineering Technology Conference 19-21 April 2005

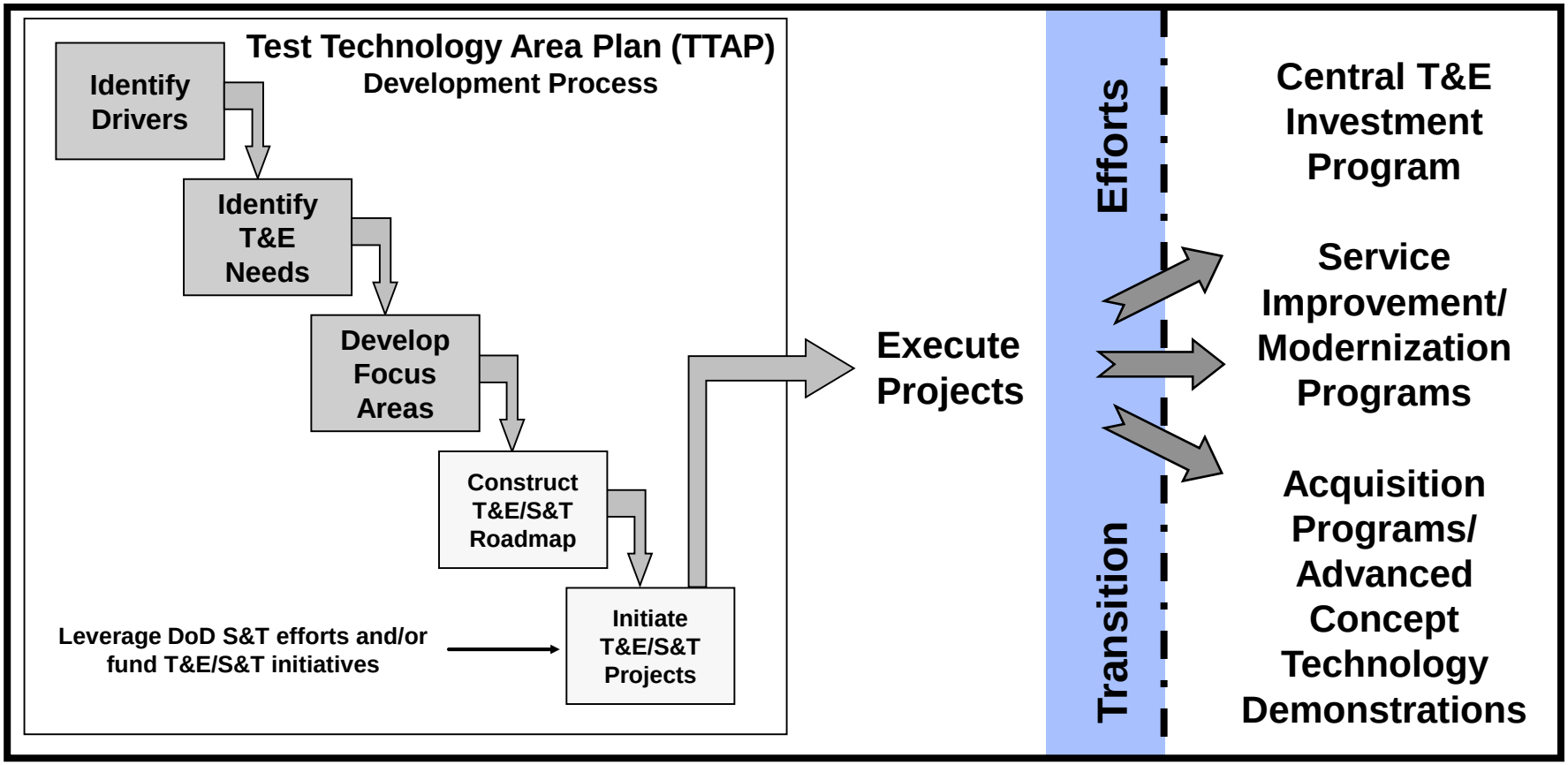
George Rumford
T&E/S&T Program Manager
DTRMC
(703) 681-4166 x 125
george.rumford@osd.mil

T&E/S&T Program
Background

- **Program started in FY 2002**
  - Joint DDR&E/DOT&E initiative
  - Transitioned to DTRMC in Feb 2005
- **Mission**
  - *Develop new technologies required to test and evaluate our transforming military capabilities*
    - *Includes any system that makes our warfighters more survivable and effective in combat*
      - *Lethal and non-lethal weapons*
      - *Intelligence surveillance and reconnaissance*
      - *Information systems*
- **Goal**

Transition emerging technologies into test capabilities in time to verify warfighting performance

T&E/S&T Program Process



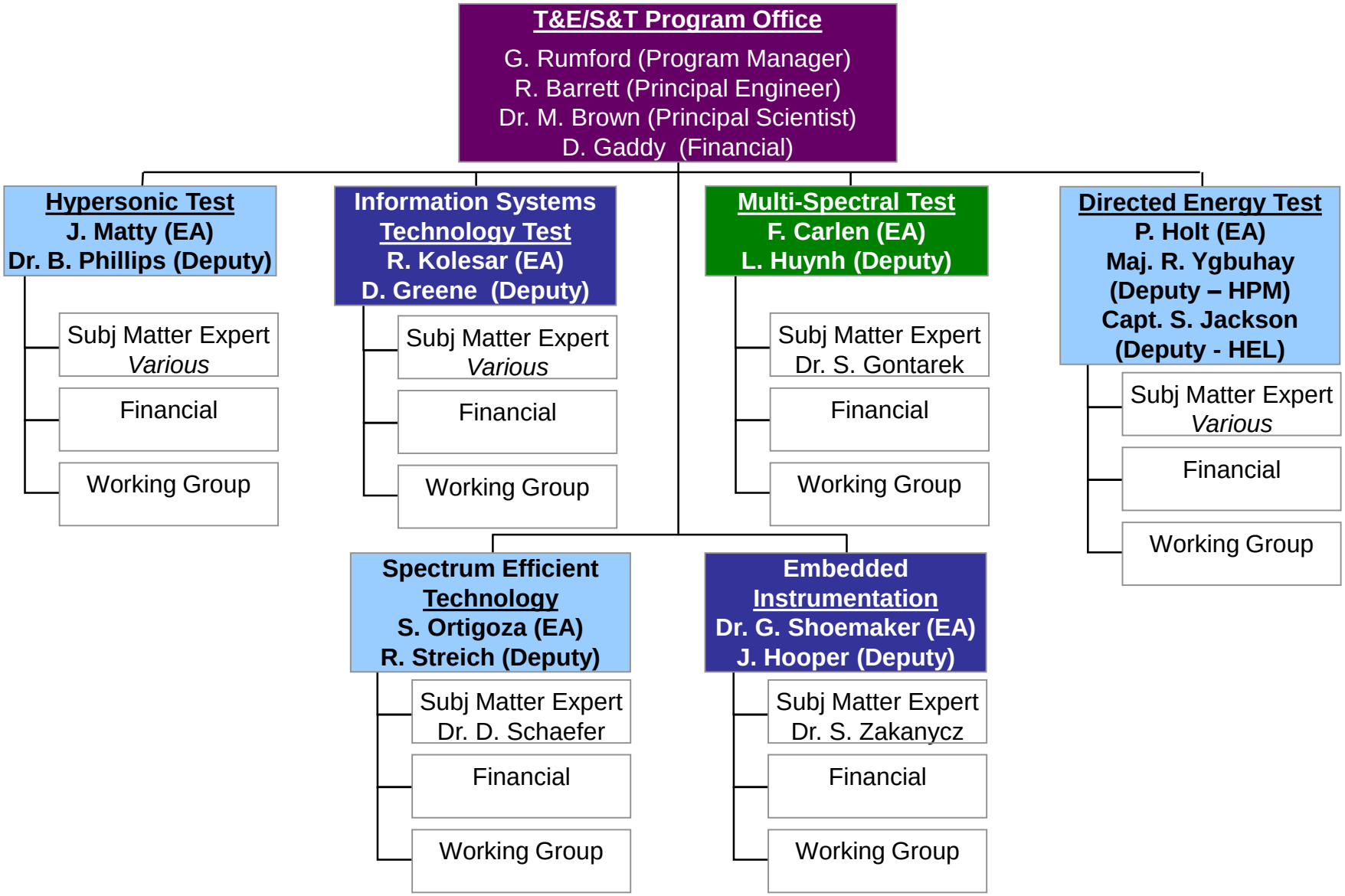
- Process used to identify focus areas
  - 9 focus areas identified
  - 6 currently active

T&E/S&T Program
Active Focus Areas

Test Technologies for

- **Emerging Warfighting Capabilities**
  - Hypersonic Vehicles
  - Directed Energy Weapons
  - Multi-Spectral / Hyper-Spectral Sensors
  - Net-Centric Warfare Systems
- **Enhanced Test Capabilities**
  - Spectrum Efficient Instrumentation Systems
  - Embedded Instrumentation

T&E/S&T Program Structure



T&E/S&T Program
Focus Area Start Up Plan

FY02

Hypersonic Test – T&E of air breathing hypersonic systems Mach 5 and above

Spectrum Efficient Technology – T&E telemetry using more efficient modulation techniques and spectrum augmentation technology

Multi-Spectral Test – Real time, realistic end-to-end T&E of multi-spectral and hyperspectral battlefield systems

FY03

Embedded Instrumentation – Technology for continuous and non-obtrusive T&E

Directed Energy Test – T&E of High Energy Laser and High Power Microwave systems

FY04

- *Mature and expand FY02 and FY03 focus areas*
- *Prepare to stand-up FY05 focus area*

FY05

Information Systems Technology Test – T&E of information systems within complex network-centric environment

FY06

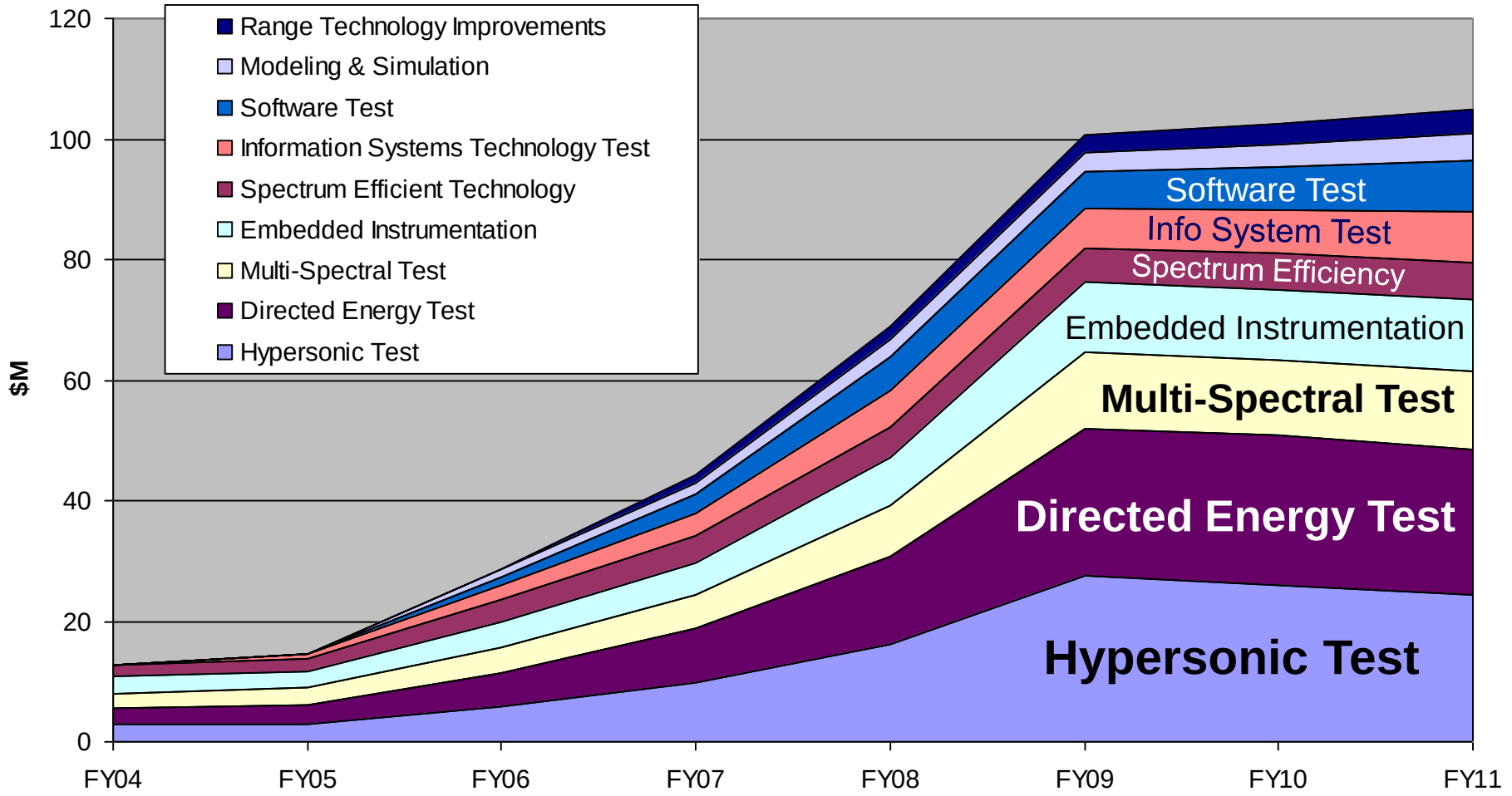
Software Test – T&E of software-intensive systems and cognitive systems

Modeling and Simulation – Advanced M&S capabilities that support test planning and T&E of future technologies, human performance, and systems of systems

FY07

Test Range/Facility Technology Improvements – Enhanced data collection, management, and after action report capabilities

FY 2004 – FY2011
Funding by Test Technology Focus Area



$12.8M	$14.7M	$29M	$44M	$69M	$101M	$103M	$105M

T&E/S&T Program
Project Selection Process



Solicitations are issued through http://www.fedbizopps.gov

Tri-Service Focus Area Working Group

- Executing Agent
- T&E Community Reps
- S&T Community Reps
- Subject Matter Experts

Needs/Requirements



Solicitations



Proposals

Source Selection Evaluation Team

- Working Group
- Subject Matter Experts
- Contracting Reps

Recommendations

Executing Agent

Final Selections

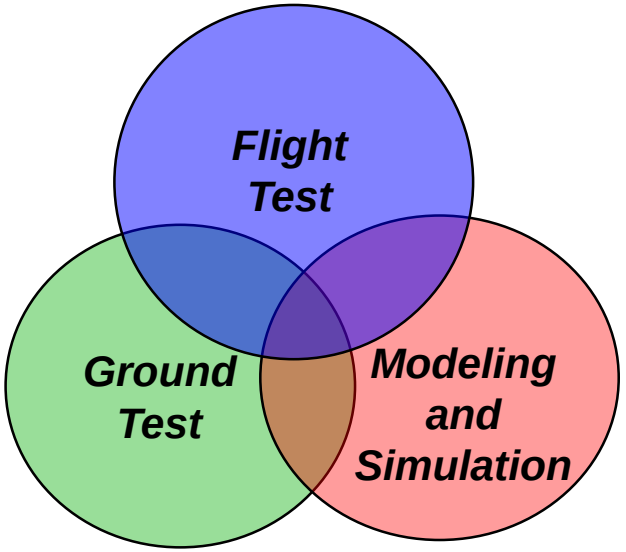
Program Manager

Funding Decision

Focus Area Execution

T&E/S&T Program
Hypersonic Test Focus Area

- **Hypersonic technology potential for rapid, long range targeting**
- **DoD hypersonic research efforts slated to transition technology to hypersonic weapon systems 2010+ timeframe**
  - National Aerospace Initiative
  - DARPA/Navy HyFly
  - Air Force Single Engine Demonstrator
- **Existing infrastructure inadequate to test envisioned systems**
  - Lead time away from meeting T&E needs
- **Need new T&E capabilities**
  - Ground test
  - Flight test
  - Modeling and Simulation
- **Supports T&E within DDR&E National Aerospace Initiative:**
  - High Speed/Hypersonics
  - Space Access
- **10 active projects**









Hypersonic Aeropropulsion System Flight Trajectory T&E

Developing the technical foundation required to incorporate variable Mach number test capabilities into Arnold Engineering and Development Center's Aerodynamic and Propulsion Test Unit (APTU) test facility

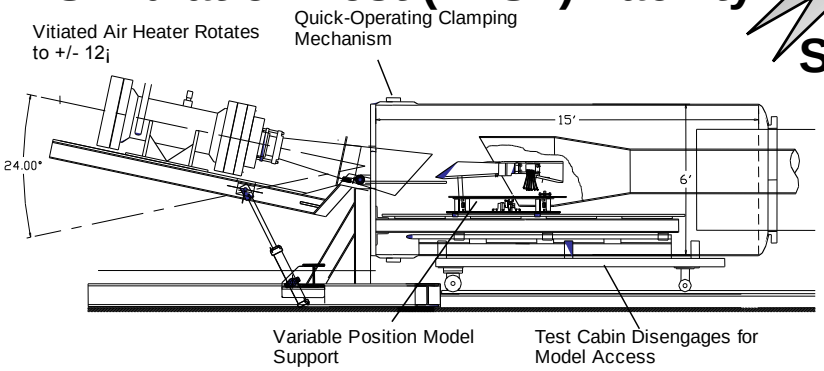


APTU Test Facility

T&E

S&T

ATK GASL Flight Acceleration Simulation Test (FAST) Facility





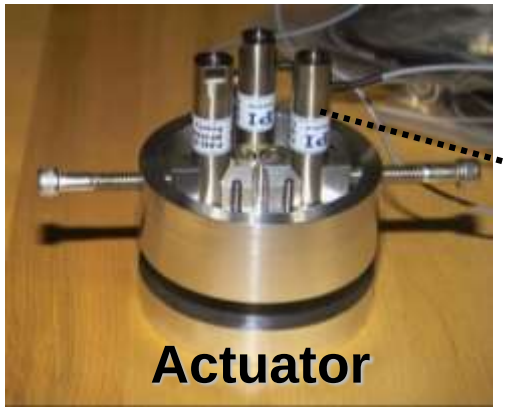
T&E/S&T Program
Directed Energy (DE) Test Focus Area

- **DE is revolutionary/transformational**
  - Focus has been on developing DE technologies, not how to test DE
  - Very little DE T&E legacy exists (infrastructure, methodology, expertise)
- **Need test technologies for:**
  - Survivable on-board instrumentation required to measure the DE beam on the target
  - Measuring the effects of DE on the target
  - Instrumentation that minimizes impacts on target performance and signature
  - Instrumentation to determine performance margins and reasons for success and failure
  - Evidence of the degree of hard kill and soft kill
  - Far field simulations in near field conditions
- **Supports T&E within DDR&E Initiative: Energy and Power Technologies**
  - Power sources for DE weapons
- **10 active projects**

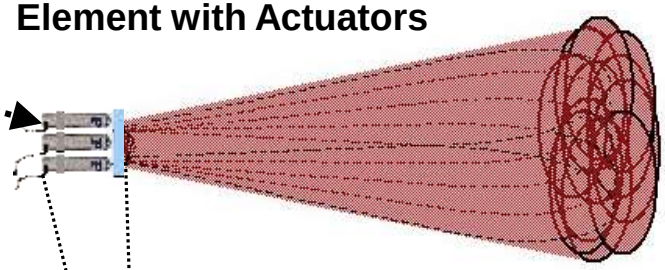




Beam Redistribution System

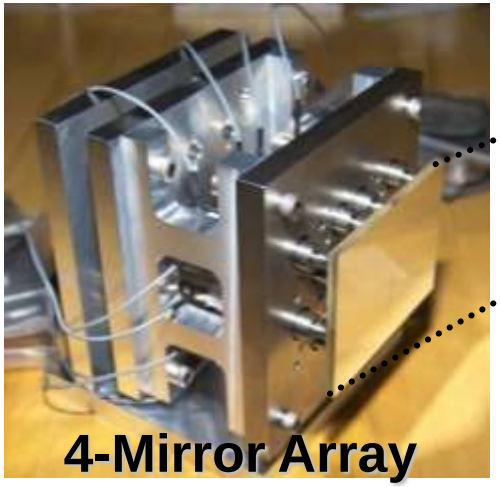


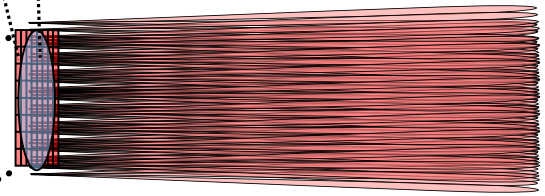
Single Randomly-Dithered Mirror Element with Actuators



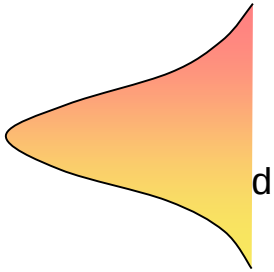


Time integral of single dithered beamlet





Segmented Mirror Array



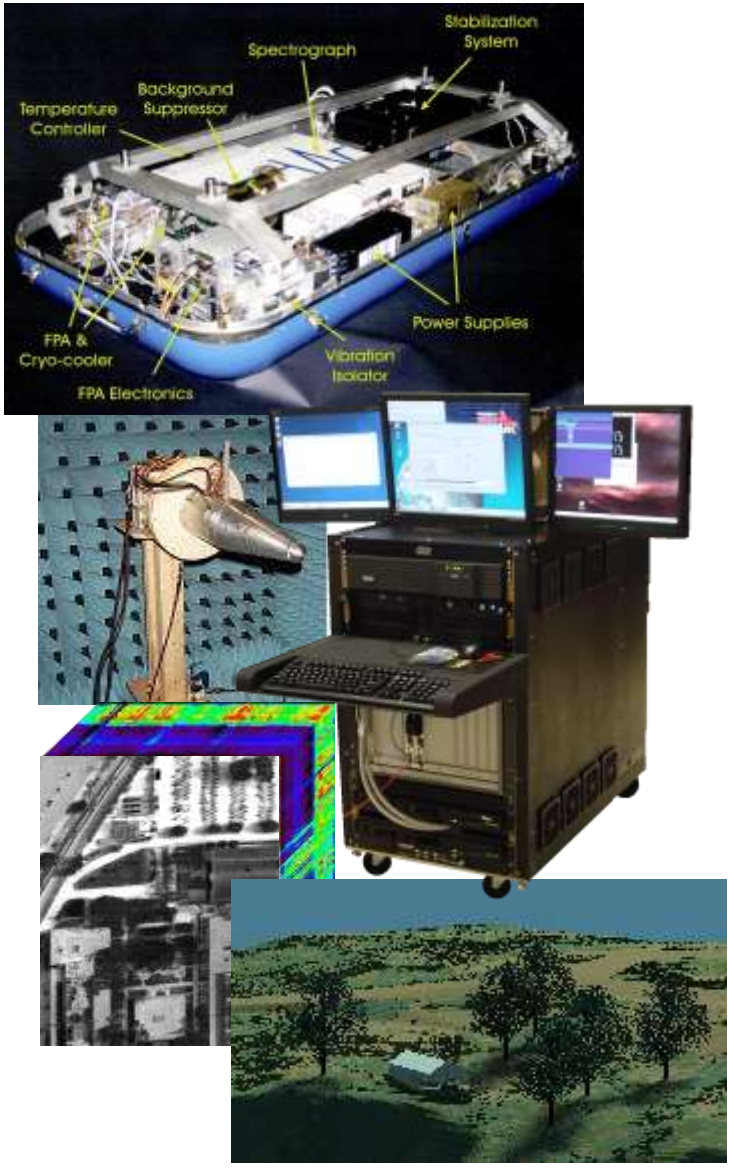
Time integral of multiple dithered beamlets

Array is composed of individual randomly dithered mirrors. Multiple mirrors can achieve integration times that are short compared with the target thermal time constant.

Developing technologies for an HEL redistribution system to reshape HEL beams to emulate far-field irradiance profiles in a near-field T&E environment

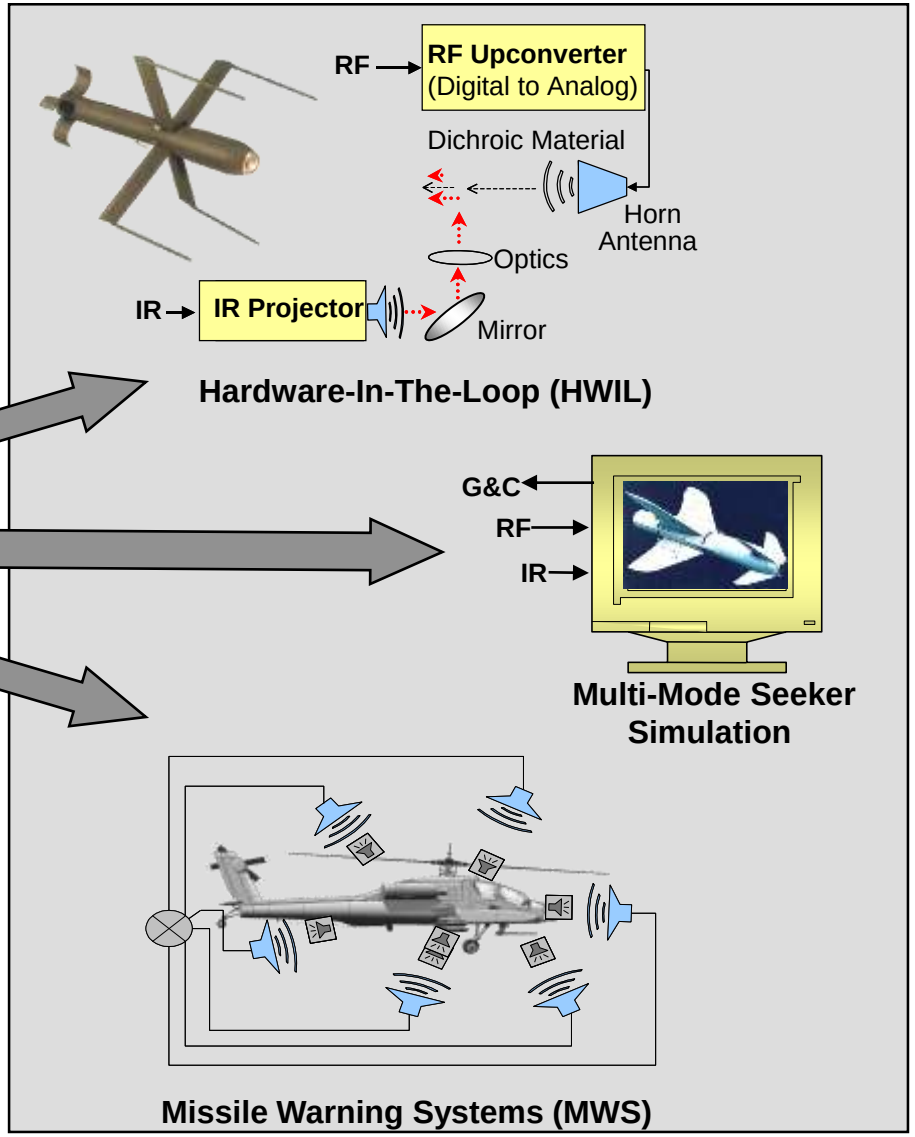
T&E/S&T Program
Multi-spectral Test Focus Area

- **Next-generation focal plane array sensors and seekers will operate through RF, UV, visible, and IR bands**
  - Need affordable processors to create scenes for T&E
  - Presentation options require wide dynamic range, fast frame rates, and realism
  - Need performance metrics that are based on scientific analysis and describe system attributes in operational terms
- **Need an end-to-end multi-spectral test capability**
  - Robust, scalable, and affordable
- **Supports T&E within DDR&E Initiative: Surveillance and Knowledge Systems**
  - Sensors and unmanned vehicles
- **4 active projects**



Multi-Spectral Stimulator Injection Test Method





Developing multi-spectral scene injection technology to provide interconnected RF & IR scene generators in synchronous and correlated operation to support T&E of multi-spectral sensor systems

T&E/S&T Program
Information Systems Technology (IST) Test Focus Area

- **Information systems are a "force multiplier" in U.S. military operations**
  - Command & Control
  - Operational Pictures/Intelligence, Surveillance & Reconnaissance (ISR)
- **Emerging, powerful information systems technologies—drive toward network centric warfare**
  - Information Assurance (IA) to protect computer networks, information, and information systems
  - Seamless, secure, self-organizing, self-healing, tactical and global communications networks
- **Need non-intrusive, IST test technologies**
  - Assess performance of networks of networks with multiplayer simultaneous activities
  - Evaluate the effectiveness of IA
  - Assess information/knowledge management
  - Test the functions of decision making systems, including the actions of intelligent agents
- **Supports T&E within DDR&E Initiative:**
  - Surveillance and Knowledge Systems
- **7 proposals under evaluation**



Information Systems Technology Test
FY2005 Broad Agency Announcement

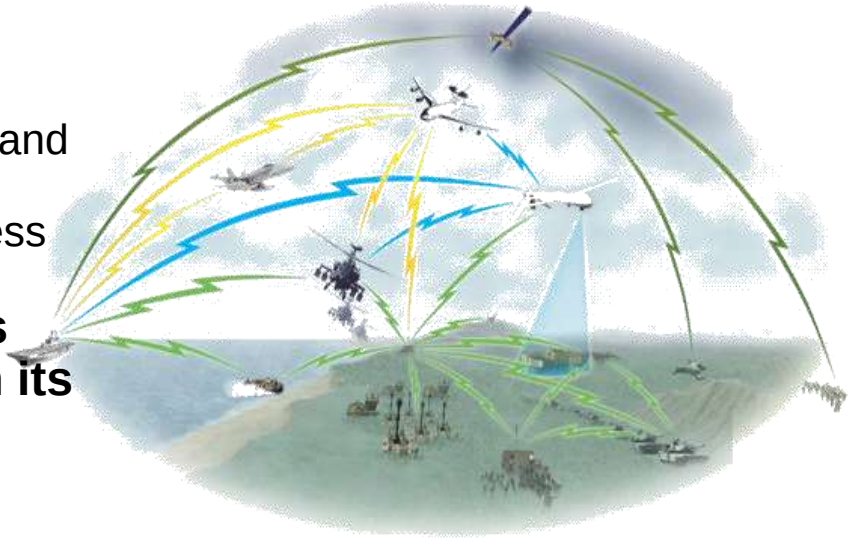
- BAA issued 20 Dec 2004
- BAA topics included technologies for T&E of
  - Communication Networks
  - Information Assurance (IA)
  - Composable Data Sources and Network Interactions
  - Decision Support

	Abstracts Submitted	Request for Proposal
DoD	8	2
Industry Prime	16	5
Academia Prime	1	0

- Proposals received on 15 March 2005
- Contract awards: April-May 2005

T&E/S&T Program
Spectrum Efficient Technology Focus Area

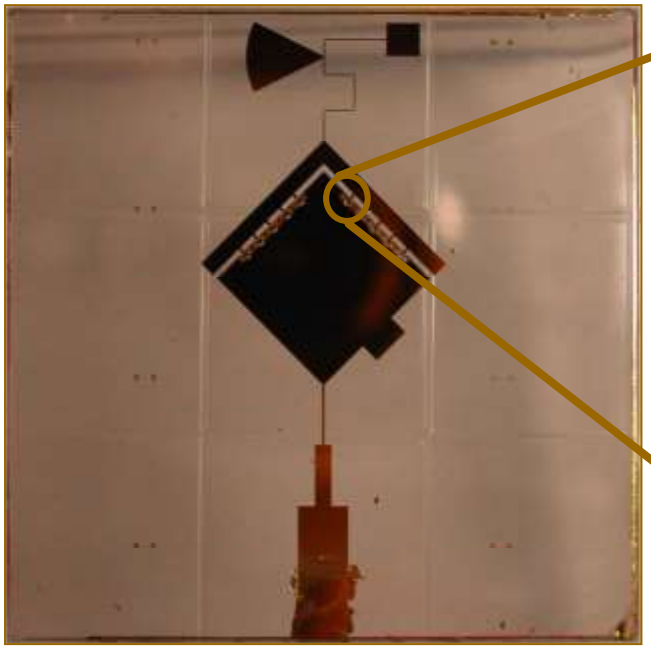
- **Growth in demand for consumer communication services**
  - Traditional bands for T&E (L and S), ideally suited for telemetry because of propagation and supportable data rates
  - Same bands desirable for commercial wireless comm
- **Each new generation of military systems generates over ten times more data than its predecessor**
  - F-15 development ~256 Kbps
  - F-22 development ~10 Mbps
- **Need more spectrum for T&E**
  - More efficient L and S band operations
  - Expand into Super High Frequency (SHF)
  - Explore Optical Band
- **DDR&E Initiative: Surveillance and Knowledge Systems**
  - High Band Width Communications/Information Assurance
- **10 active projects**

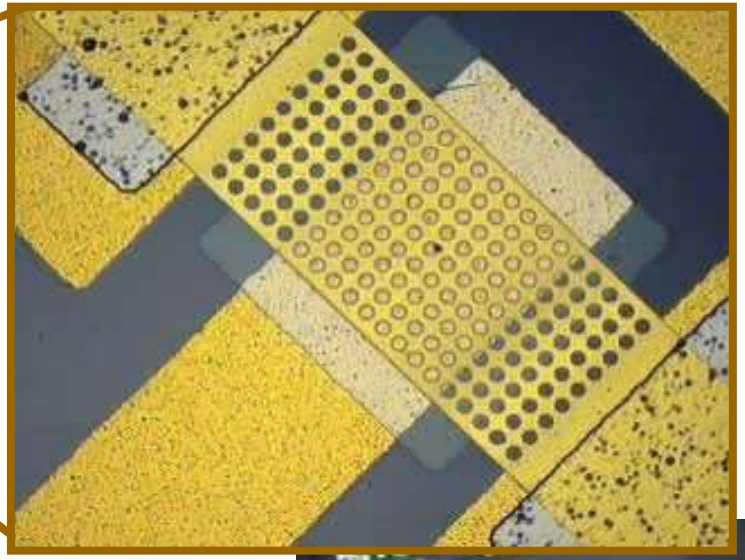


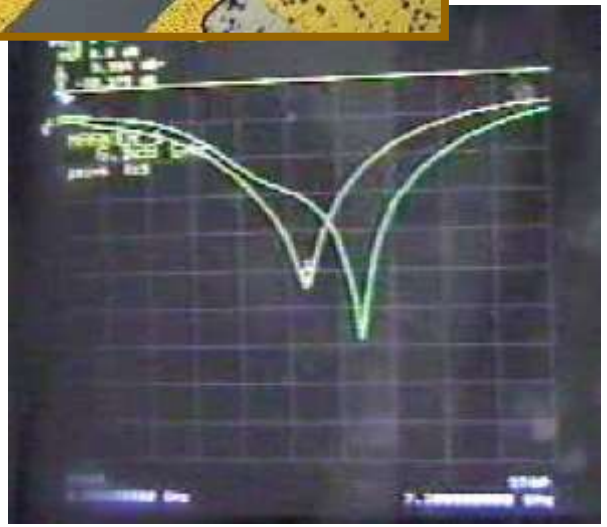




RF MEMS Antenna



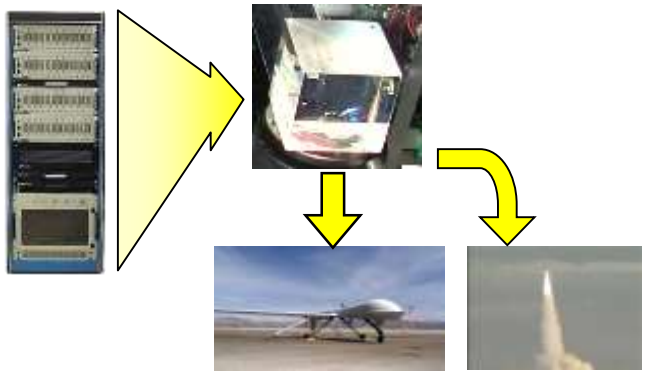


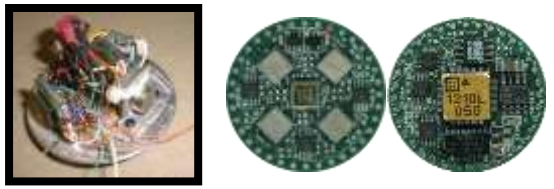


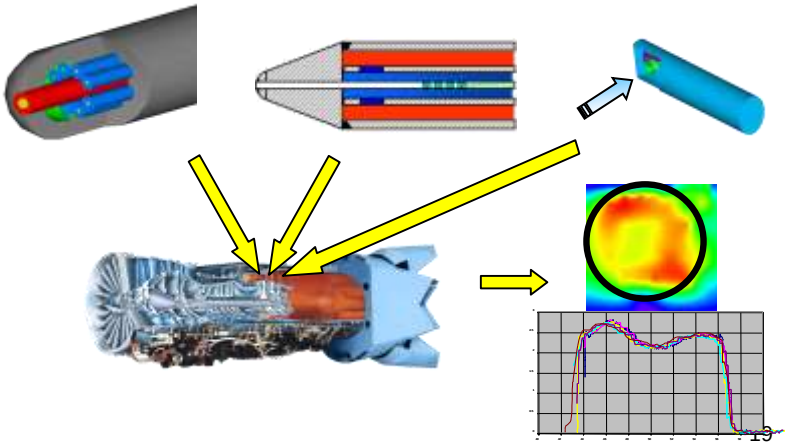
Developing microelectromechanical systems (MEMS) based antenna technology to support reconfigurable (software-defined) phased array antennas for aeronautical telemetry applications

T&E/S&T Program
Embedded Instrumentation (EI) Focus Area

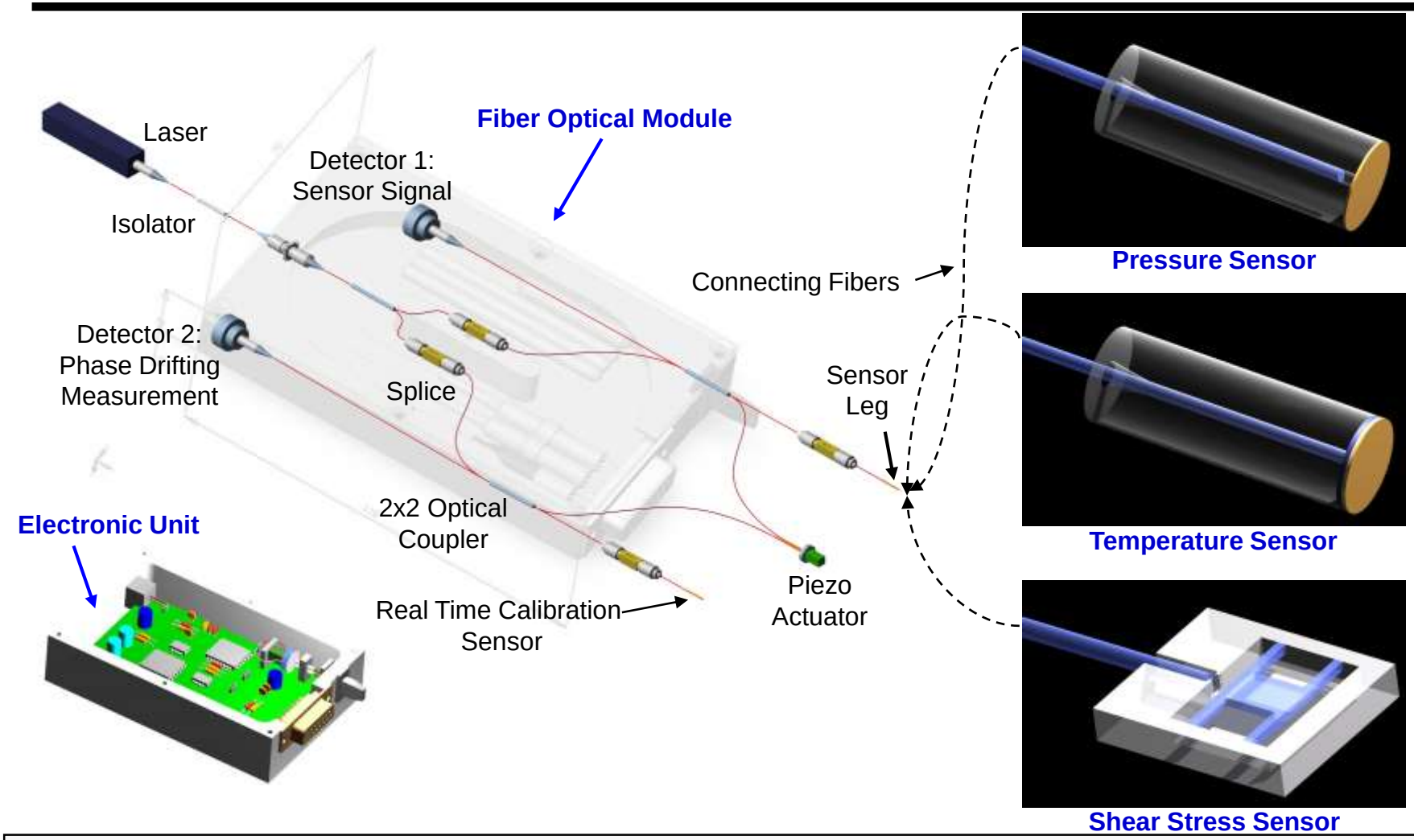
- **Military systems smaller, more capable, complex, interdependent, and interoperable**
  - Scarce space for sensors, wiring, and data processing and storage
  - Must minimize effects of instrumentation to the signature/ performance of the system-under-test
- **EI has the potential for providing cost savings and enhancing force readiness**
  - Key is to design EI in up front
  - CJCSI 3170.01C—The Initial Capabilities Document (ICD) and the Critical Development Document (CDD) must include consideration for EI
  - Director, J-6, Joint Staff will ensure that CDDs and Critical Production Documents (CPDs) include EI in systems tradeoff studies
- **Need technologies and architectures for non-intrusive, survivable instrumentation suites**
  - Both plug-and-play and open architectures
- **Supports T&E within DDR&E Initiatives:**
  - NAI
  - Surveillance and Knowledge Systems
  - Energy and Power Technologies
- **11 active projects**







MEMS Fiber Optic Sensors



Developing miniaturized embedded sensor technology to collect complete sets of pressure, temperature and shear stress data on a single sensor head module

T&E/S&T Program
Wrap Up

- **T&E/S&T program initiated to address critical T&E needs, tied to S&T drivers**
- **Sustained growth and demonstrated value**
  - Mature focus areas transitioning technology into test capabilities
- **Keys to continued success**
  - Participation of Services on Joint needs definition
  - Good mix of industry, laboratories and universities working on solutions
  - Participation of Services, industry, laboratories and universities to transition technologies to T&E capabilities

Shaping Technology into Tomorrow's T&E Capabilities



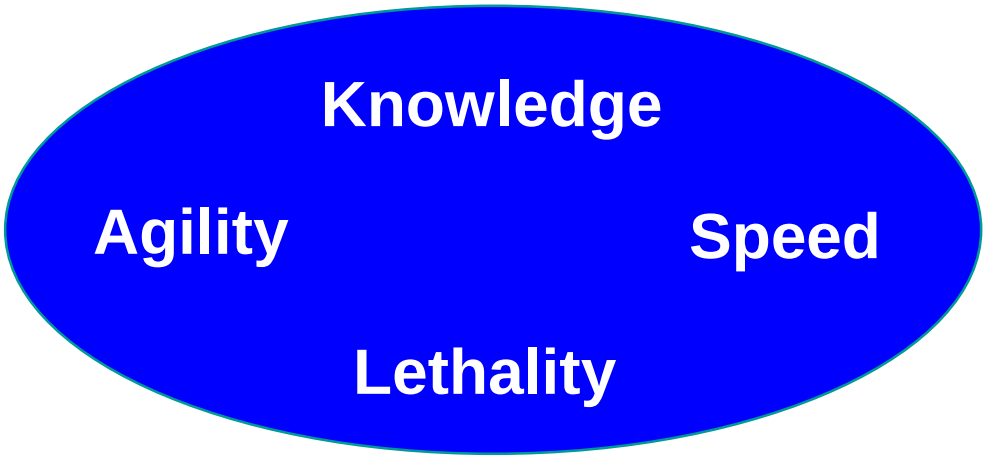
Defense Research and Engineering Update

6th Annual Science and Engineering Technology Conference

Dr. Ronald M. Sega
Director of Defense Research and Engineering

April 19, 2005

Technology and Transformation
Transformational Attributes



- **DDR&E Transformation Technology Initiatives**
  - **National Aerospace Initiative**
  - **Energy and Power Technologies**
  - **Surveillance and Knowledge Systems**

Research and Engineering Goals

- **Purpose: Ensure the United States Armed Forces will have decisive technological capability advantages over potential adversaries**
- **Goals demonstrate advances in near-term capability while maintaining a steady flow of technology options for the future force**
- **Goals are characterized as Process, Technical Capability, and Enabling Technology**

Research and Engineering Goals

Process Goals

R&E Program shall:

- Focus on transitioning military relevant technology to the warfighter
- Support the education of more scientists and engineers
- Increase emphasis on near-term technologies that can be accelerated and transitioned to meet immediate warfighting needs
- Shall archive and reuse information generated by the global R&E community (utilize DTIC)
- Develop an improved capability to affordably build military systems through improved systems engineering

DoD shall:

- Sustain an investment in university research
- Support strategic investments in technologies supporting irregular, catastrophic, and disruptive technologies

Research and Engineering Goals

Technical Capability Goals

- **Divided into five areas:**
  - **Protection**
  - **Force Sustainment**
  - **Situation Awareness**
  - **Strike**
  - **Cross-Cutting**

Research and Engineering Goals

Technical Capability Goals

Protection

Develop technologies to:

- **Increase capability to detect, identify movement of, and mitigate WMD**
- **Extend the safe zone around bases of critical infrastructure**
- **Provide effective cruise and ballistic missile defense against LO and/or high speed targets**

Force Sustainment

Develop technologies to:

- **Reduce logistics or manpower demands on existing forces and increase the life-span of current weapons**
- **Enable rapid force projection and deployment**

Research and Engineering Goals

Technical Capability Goals

Situation Awareness

- Develop information technologies to provide robust, reliable, survivable and secure, self-forming networks
- Develop C4ISR technologies to increase the capability to find, fix, track and identify friendly/enemy forces in real time

Strike

- Develop technologies to support the fielding of alternative strike weapons for both conventional weapons and hard target defeat.

Cross-Cutting

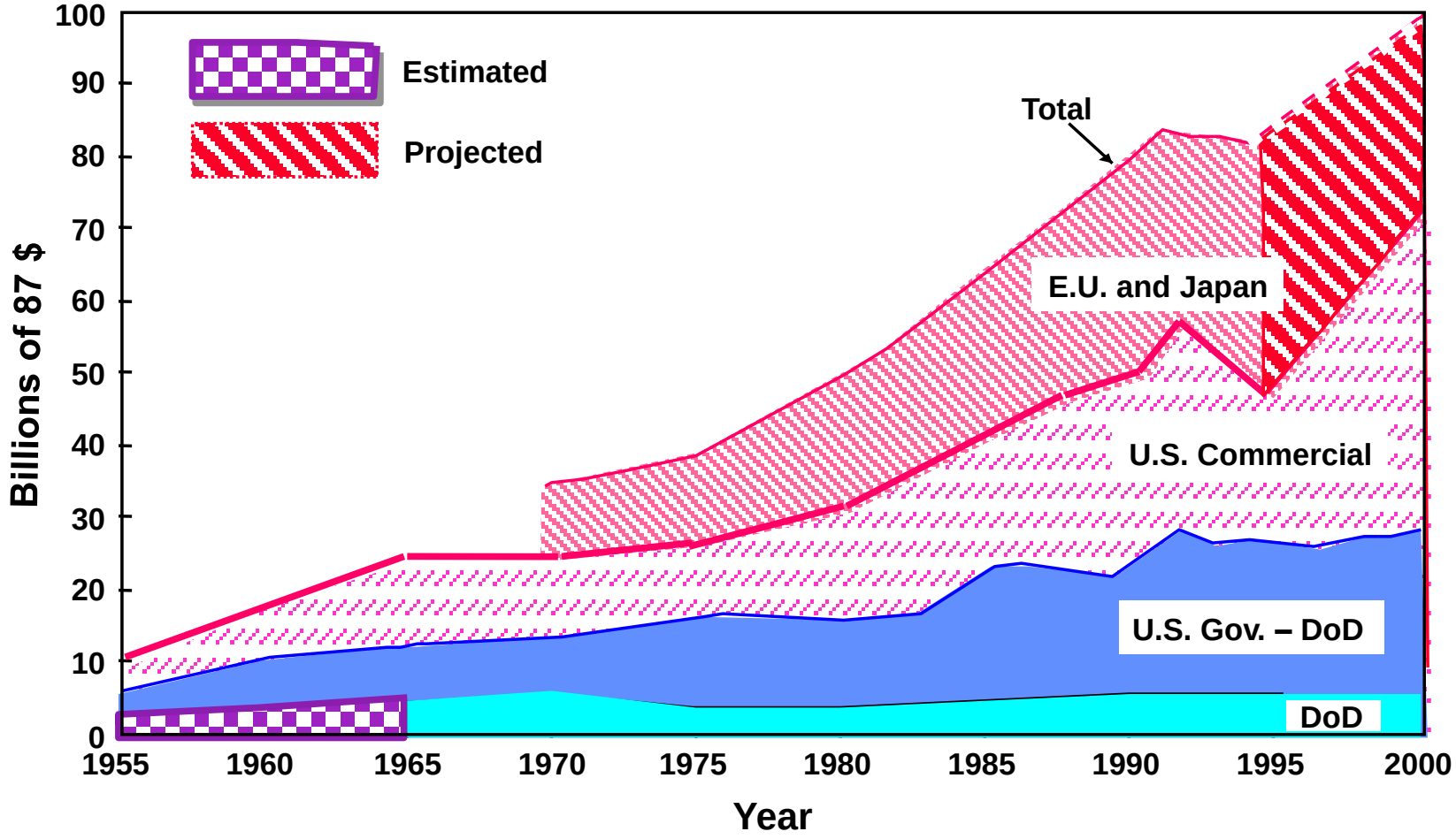
- Reduce the cost and time required for space launch through the pursuit of reusable vehicles
- Enhance the realism, effectiveness, and accessibility of training and mission rehearsal

Research and Engineering Goals

Enabling Technology Goals

- **Nanotechnology**
- **Biotechnology**
- **Unmanned and autonomous vehicles**
- **Quantum communications/computing technology**
- **Networked Systems**
- **Advanced Materials**
- **Intellectual Capital (Workforce)**
- **DoD R&E Infrastructure**
- **Modeling, simulation, computation and software for complex systems**

Worldwide Research Base is Growing



Source: Report of the Defense Science Board Task Force on the Technology Capabilities of Non-DoD Providers; June 2000; Data provided by the Organization for Economic Cooperation and Development & National Science Foundation

Global S&T Development

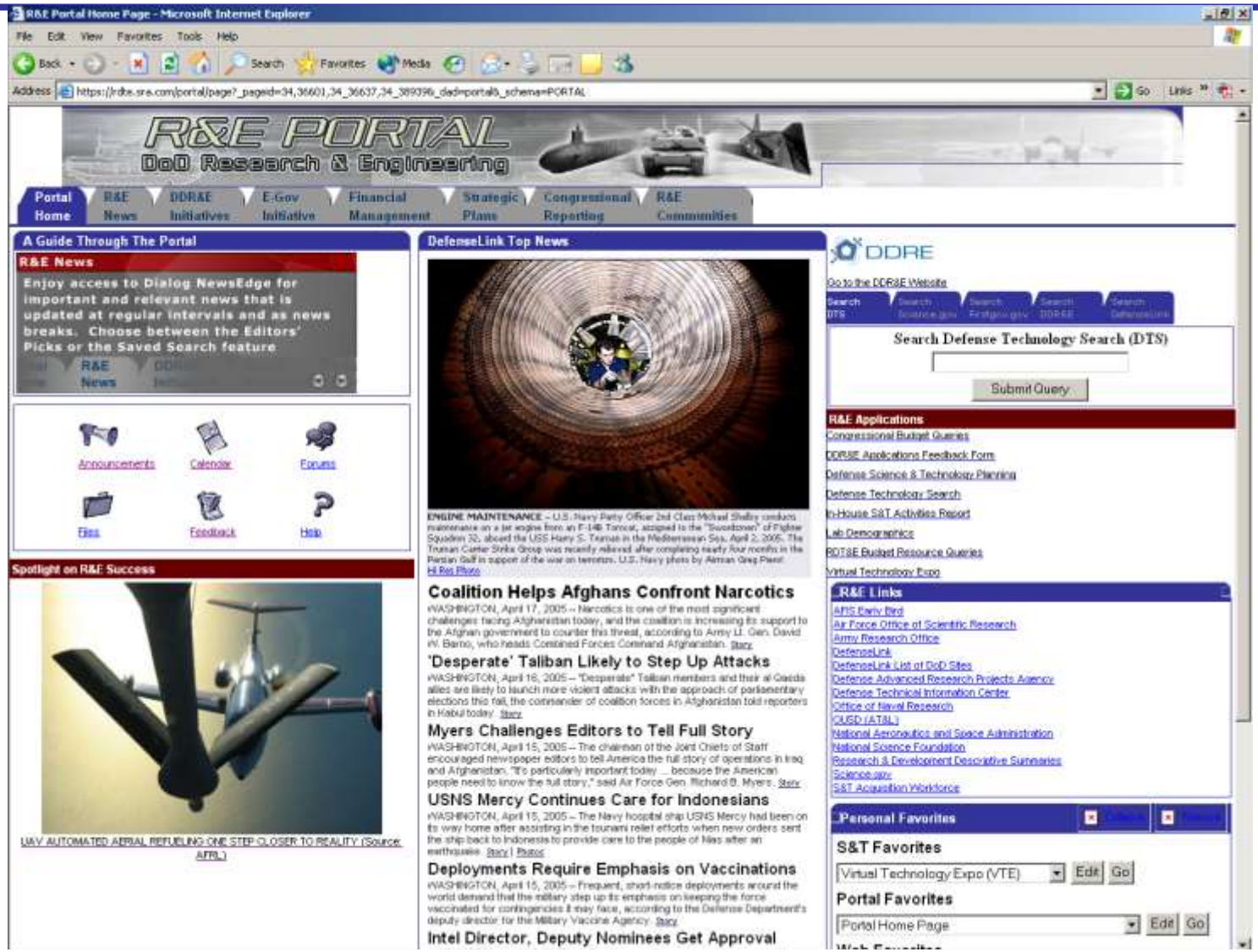
Every DoD Researcher, Acquisition Professional, Tester, and Operator should be able to sit down at their Desktop computer and be able to find out:

- **What the DoD is doing in R&E**
- **Why we are doing the work**
- **When the work will be done**
- **Who knows more about this information**
- **What everyone else in doing in R&E (globally)**

"Smarter Google" for the RDT&E and Warfighter Community

R&E Portal

https://rdte.osd.mil



A National Issue

- **"An Emerging and Critical Problem of the Science and Engineering Workforce"[1]**
  - **12 Major studies (1999-2004) make essentially the same point**
  - **A few studies did not consider security clearance needs and rely on relaxation of immigration rules**

- **Growing need for U.S. citizens in national security activities**

1. National Science Board Companion Paper to "National Science and Engineering Indicators 2004", National Science Foundation, April 2004

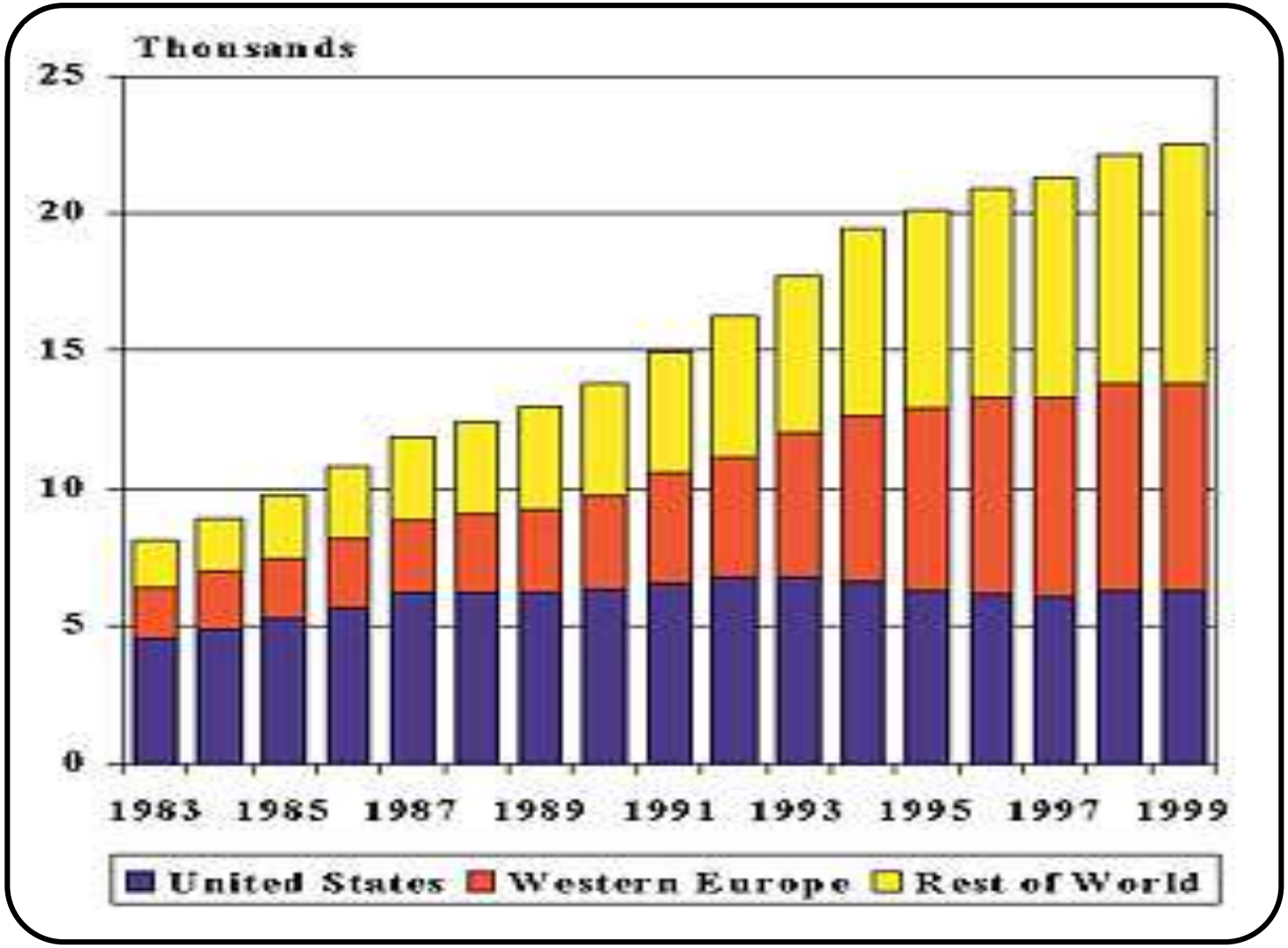
DoD Scientists & Engineers (S&E)

- **"Attrition" in DoD labs: ~13,000 Science and Engineering departures projected within 10 years**
- **The number of clearable students pursuing defense-related critical skills degrees and is declining**
- **Projected U.S. demand for S&E's will be up 10% by 2010 (Bureau of Labor Statistics 2001)**

Physical Review Trends

Physical Review & Physical Review Letters

Total Submissions



Source: American Physical Society - *APS News August/September 2000*

DoD S&Es as % of Total Fed S&Es

Source: Pre-release - OPM data for NSF pub, Table B-14. Federal scientists and engineers, by agency and major occupational group: 1999-2002

	1999	2000	2001	2002
Total S&Es	44.2%	43.5%	43.1%	43.4%
All sci	26.1%	25.4%	25.6%	26.9%
Comp/Math sci	45.5%	43.9%	44.0%	45.3%
Life sci	11.4%	11.2%	11.0%	10.9%
Physical sci	26.7%	26.2%	26.1%	26.2%
Social sci	20.4%	20.4%	19.7%	19.6%
All eng	66.7%	66.4%	66.2%	66.7%
Aerospace	44.7%	43.6%	43.0%	42.8%
Chemical	62.3%	63.6%	65.7%	67.6%
Civil	61.8%	61.3%	60.6%	60.1%
EE&Comp	79.3%	79.1%	78.5%	79.1%
Industrial	81.1%	80.2%	79.4%	79.4%
Mechanical	88.2%	88.2%	88.4%	89.2%
Other eng	54.6%	55.1%	55.5%	55.9%

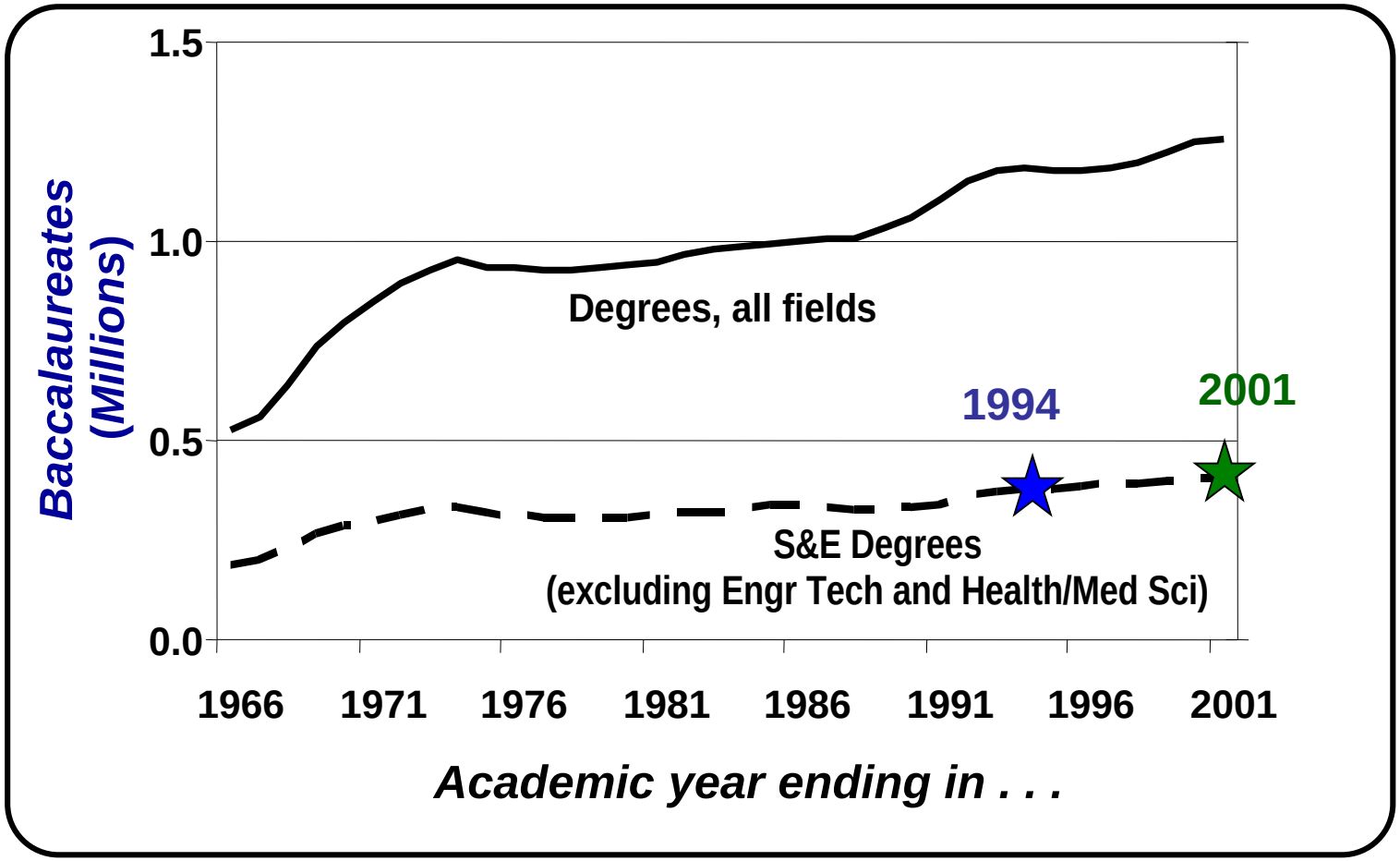
DoD Percent of Federal Research
Basic and Applied Research (FY01)

	Fed Total	Univ. Research	Univ. Basic	Univ. Applied
Aeronautical	44%	51%	26%	75%
Astronautical	16%	13%	45%	5%
Electrical Engineering	81%	71%	72%	66%
Mechanical Engineering	78%	74%	74%	70%
Metallurgy & Materials	46%	44%	34%	76%
Civil Engineering	23%	5%	2%	15%
All Engineering	44%	43%	38%	54%
Mathematics	21%	13%	11%	21%
Computer Science	37%	34%	11%	88%
All Fields of Research	15%	9%	10%	9%

Source: Federal Funds for R&D, NSF Report #04-310

U.S. Production of S&E Graduates*

U.S. College and University Graduates, 1966-2001



**Source: Data provided by the NSF, September 2003*

U.S. University Trends in Defense-Related S&E

Graduate Student Enrollment (1994-2001)

**Source: National Science Foundation – Graduate Students and Post Doctorates in Science and Engineering: Fall 2001*

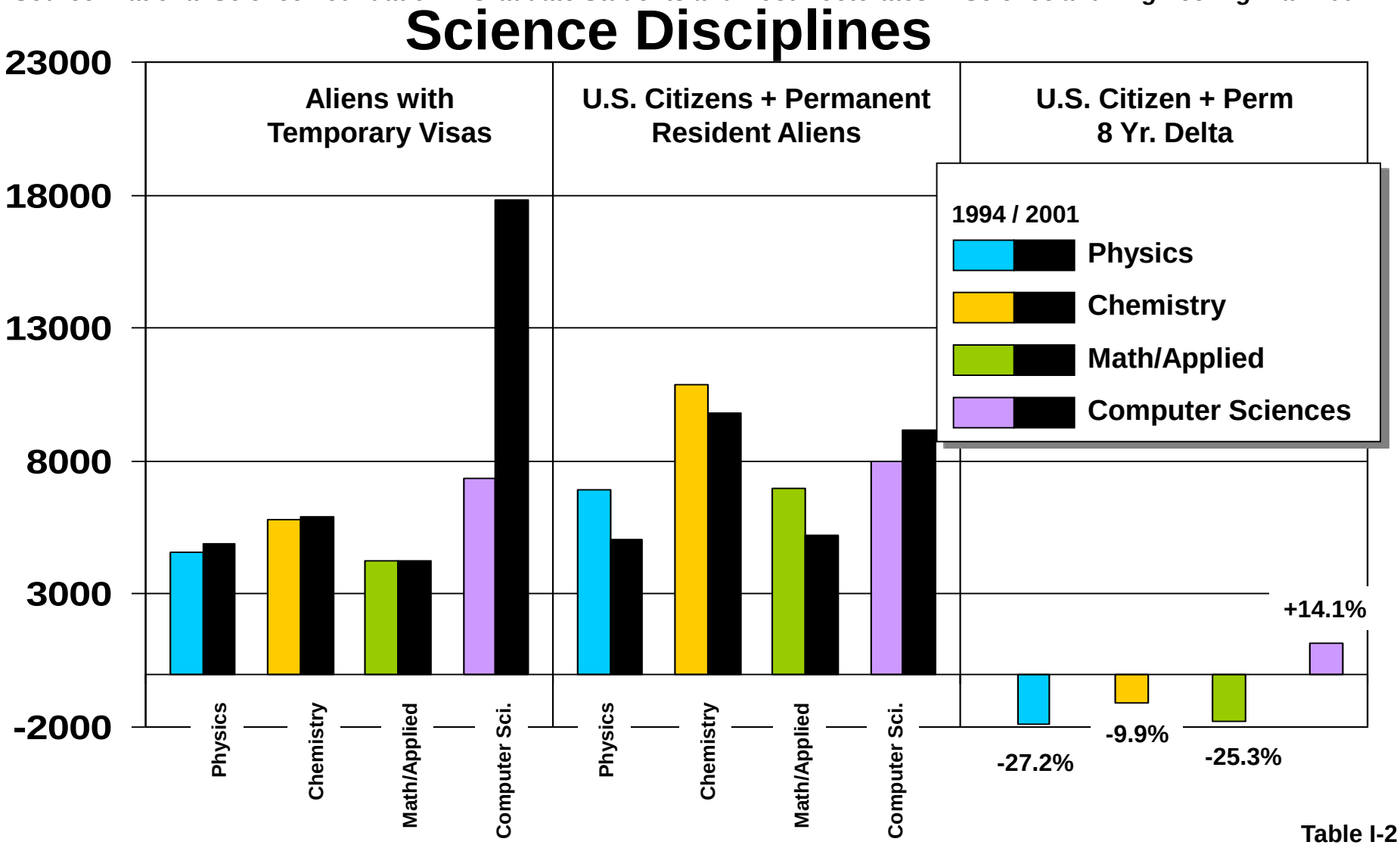


Table I-2

U.S. University Trends in Defense-Related S&E
Graduate Student Enrollment (1994-2001)

**Source: National Science Foundation – Graduate Students and Post Doctorates in Science and Engineering: Fall 2001*

Engineering Disciplines

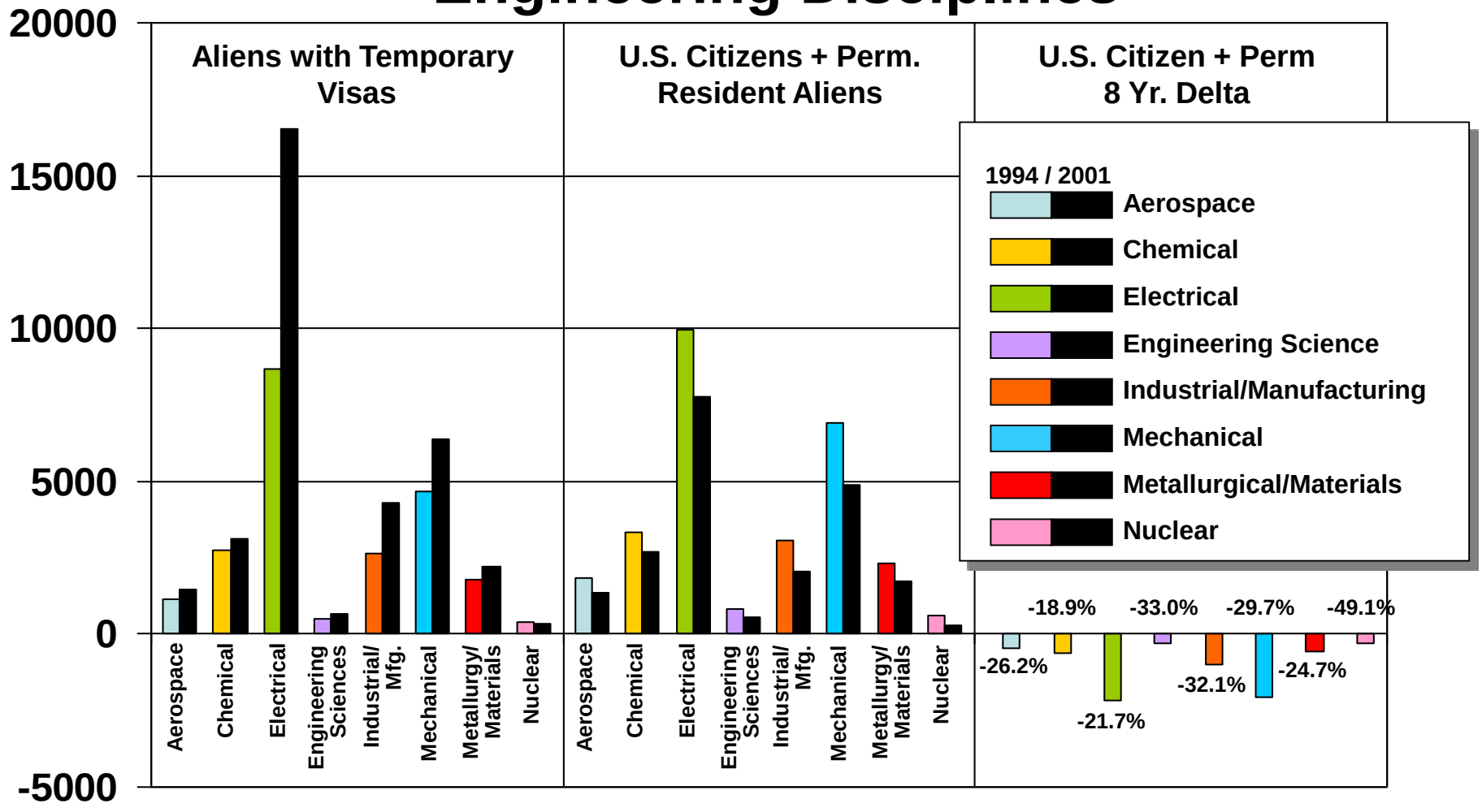


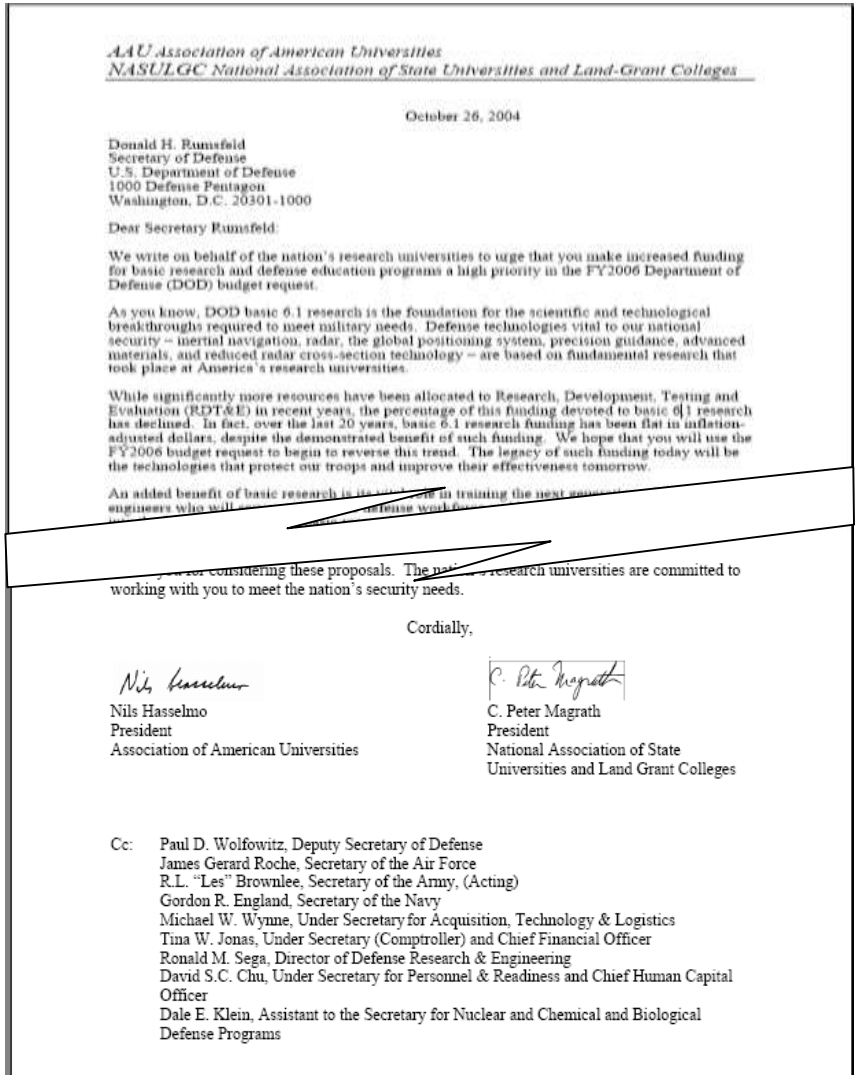
Table III

Science, Mathematics and Research for Transformation (SMART)

- **SMART Legislation Passed (NDAA 2005)**
- **Elements of the Pilot Program**
  - **US Citizens**
  - **Scholarship/Fellowship: Bachelors, Masters, PhD**
  - **Defense related critical disciplines**
  - **Payback required - Employment after Degree**
- **Implementation**
  - **Broad Participation (Army, Navy, AF, DARPA, DISA, DTRA)**
  - **Preliminary selections made April 13, 2005**

AAU Letter to Secretary Rumsfeld

- Supported increased funding for Research
- Defense Education Programs
- 6.1 research is foundation for S&T breakthroughs
- Future challenges cannot be met without appropriately educated and trained workforce
- Specific support for SMART
- Specific support for NDEP



AAU Association of American Universities
NASULGC National Association of State Universities and Land-Grant Colleges

October 26, 2004

Donald H. Rumsfeld
Secretary of Defense
U.S. Department of Defense
1000 Defense Pentagon
Washington, D.C. 20301-1000

Dear Secretary Rumsfeld:

We write on behalf of the nation's research universities to urge that you make increased funding for basic research and defense education programs a high priority in the FY2006 Department of Defense (DOD) budget request.

As you know, DOD basic 6.1 research is the foundation for the scientific and technological breakthroughs required to meet military needs. Defense technologies vital to our national security – inertial navigation, radar, the global positioning system, precision guidance, advanced materials, and reduced radar cross-section technology – are based on fundamental research that took place at America's research universities.

While significantly more resources have been allocated to Research, Development, Testing and Evaluation (RDT&E) in recent years, the percentage of this funding devoted to basic 6.1 research has declined. In fact, over the last 20 years, basic 6.1 research funding has been flat in inflation-adjusted dollars, despite the demonstrated benefit of such funding. We hope that you will use the FY2006 budget request to begin to reverse this trend. The legacy of such funding today will be the technologies that protect our troops and improve their effectiveness tomorrow.

An added benefit of basic research is its [illegible] in training the next [illegible] engineers who will [illegible] defense work [illegible]

[illegible] considering these proposals. The nation's research universities are committed to working with you to meet the nation's security needs.

Cordially,

Nils Hasselmo
President
Association of American Universities

C. Peter Magrath
President
National Association of State Universities and Land Grant Colleges

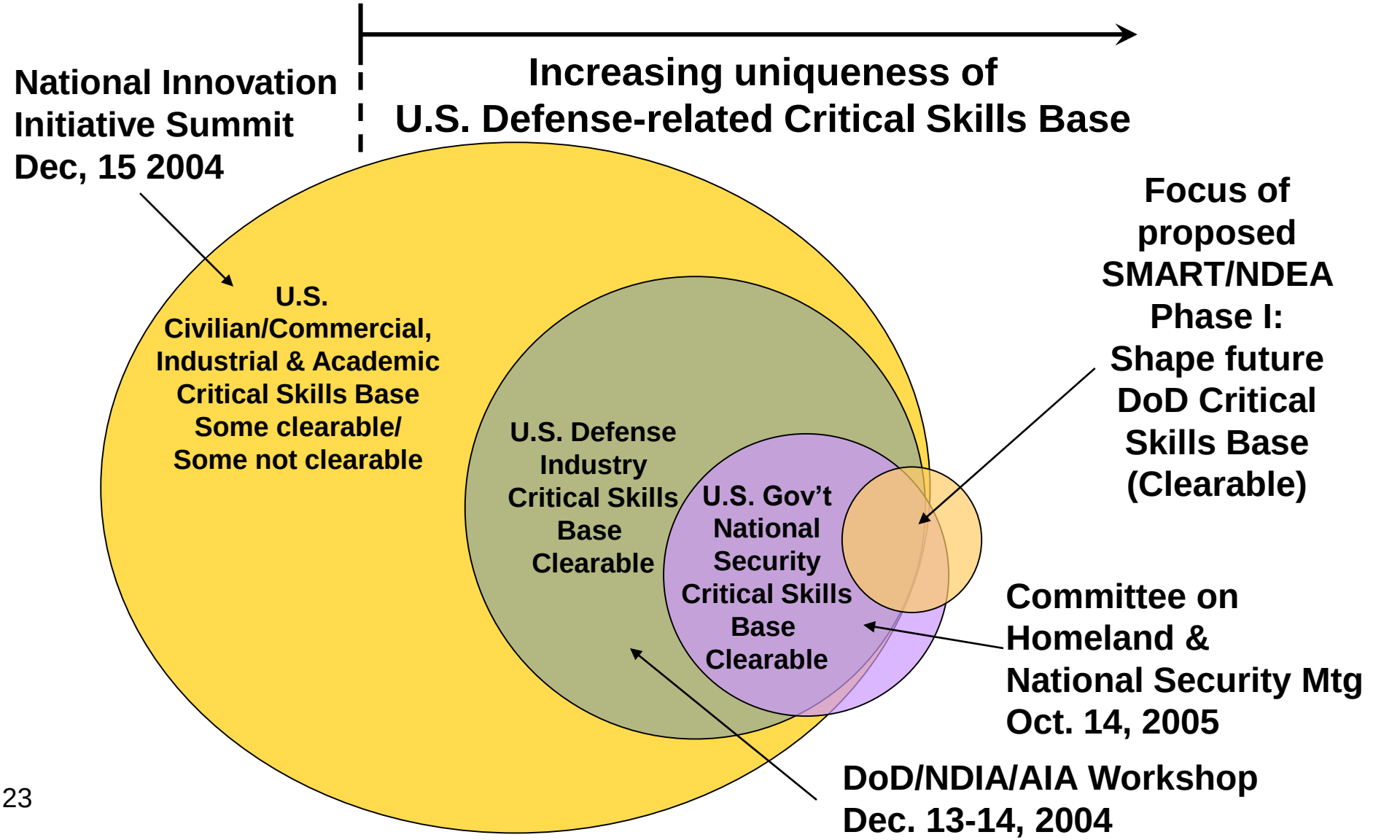
Cc: Paul D. Wolfowitz, Deputy Secretary of Defense
James Gerard Roche, Secretary of the Air Force
R.L. "Les" Brownlee, Secretary of the Army, (Acting)
Gordon R. England, Secretary of the Navy
Michael W. Wynne, Under Secretary for Acquisition, Technology & Logistics
Tina W. Jonas, Under Secretary (Comptroller) and Chief Financial Officer
Ronald M. Sega, Director of Defense Research & Engineering
David S.C. Chu, Under Secretary for Personnel & Readiness and Chief Human Capital Officer
Dale E. Klein, Assistant to the Secretary for Nuclear and Chemical and Biological Defense Programs

Proposed Defense Education Activities for FY06

- **FY06 President's Budget Request (PBR)**
  - **SMART/National Defense Education Act (NDEA) – Phase I submitted**
  - **Elements of SMART Pilot Program made permanent**
  - **Funding Request: $10M for FY06 ($2.5M in FY05)**
- **Additional Options Under Consideration**
  - **Adding Associates degree**
  - **Option for DoD to employ students during course of study**
  - **Expanded allowable expenses (i.e. Research Support & Equipment)**
  - **Clearance process could begin during course of study**
  - **Summer Internships**
  - **Critical technical disciplines and foreign language**

Initial DoD Critical Skills Focus

Proposed SMART/NDEA Phase 1 Relative to Other U.S. Sectors



Summary

- **The DoD R&E program remains focused on transformation**
- **Instituted R&E Goals**
- **Need to expand global outreach and make information easier to access**
- **Workforce Development is a collaborative effort between Government, Industry, and Academia**

BACKUP

The Challenge: Pace of Technology

"Moore's Law" → **Computing doubles every 18 months**

"Fiber Law" → **Communication capacity doubles every 9 months**

"Disk Law" → **Storage doubles every 12 months**

Defense Acquisition Pace

F-22	**Milestone I:**	**Oct 86**	**IOC:**	**Dec 05***
Comanche	**Milestone I:**	**Jun 89**	**IOC:**	**Sep 09**

*** Computers at IOC are 512 X faster, hold 65,000 X bits of information than they did at MS I**

Technology growth is non-linear…
Acquisition path has been linear

Global S&T Development

- **The rise in global science and technology (S&T) development over the last decade has produced a research and engineering (R&E) landscape that is more dynamic and is experiencing an increasing rate of change.**

- **Understanding the global research and engineering landscape is critical to maintaining a vigorous, responsive and productive U.S. defense research and development program, which provides technology enablers for present and future capabilities for operational forces.**

Disruptive Technology: An Uncertain Future

Mr. Alan R. Shaffer

21 May 2005

Director of Plans & Programs

Defense Research and Engineering

Future Battlespace



"Innovation within the armed forces will rest on experimentation with new approaches to warfare, strengthening joint operations, exploiting U.S. intelligence advantages, and taking full advantage of science and technology….."

The National Security Strategy of the United States, September 2002

Definition of Disruptive Technology

The Textbook Definition

- **Harvard Professor, Clayton Christensen* described disruptive technologies as a lower-performance (but cheaper) new product that can be improved more rapidly, so that performance outpaces the product it is replacing**

- **Key concepts:**
  - **Greater performance than previous product**
  - **Replaces (drives) old product out of market**

**** "The Innovator's Dilemma", 1997***

Disruptive Technology
The Non-Textbook Definition

- **For Defense systems, lower cost and lower initial performance does not matter**
- **What matters is rapid evolution from old, stable technology to new, dominating technology**
- **A technology surprise that gives a competitor an advantage**
  - **Business - Technology that overturns market**
  - **Military - Technology that causes a fundamental change in force structure, basing, and capability balance**
- **Disruptive Technologies may arise from systems or enabling technology**

Definition of Disruptive Technology

Some Historical Examples--Commercial

Candle	→	Electric Light
Vacuum Tubes	→	Transistors
Mechanical Watches	→	Quartz Watches
Mainframe Computers	→	Personal Computers





In each case, the disruptive technology decimated the conventional market - in a very short time

Definition of Disruptive Technology

Some Historical Examples--Military

Spotter	→	Radar
Bombers	→	ICBMs
Horse Drawn Artillery	→	Armored Howitzers
Flares	→	Night Vision Goggles





In Each Case, the Disruptive Technology Changed the Force Structure

A Focus on Revolutionary Advances

Stealth



Adaptive Optics and Lasers



GPS



Night Vision



Phased Array Radar



Definition of Disruptive Technology

Extended to the DoD

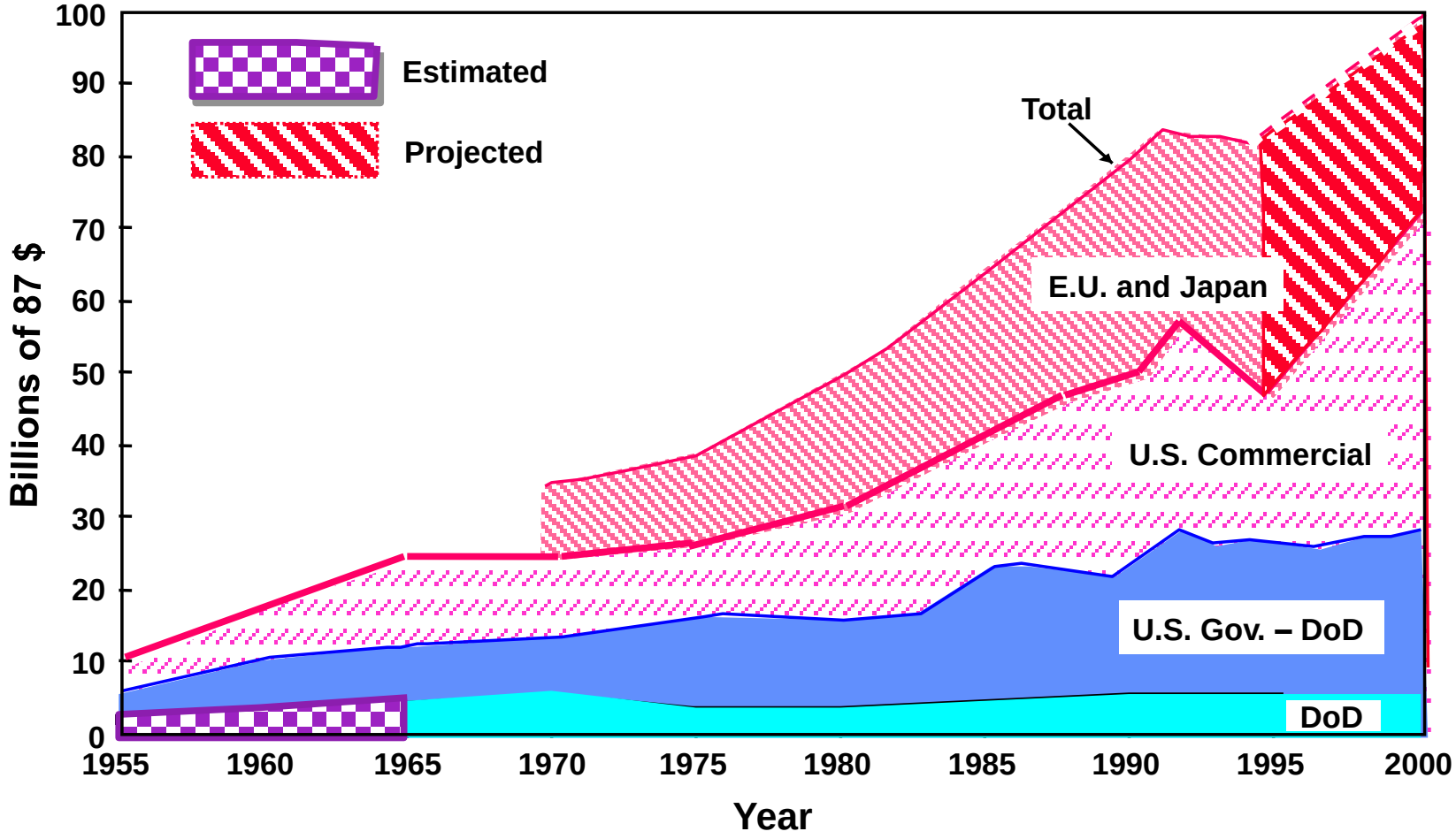
- **For Military Application, a Disruptive Technology may be offensive, defensive, or "spin-off"**
  - **Offensive - A capability developed to provide a "transformational" new capability**
  - **Defensive - A capability developed in response to someone else's advantage**
  - **Unintended - A capability developed for commercial….but with military applications**

Disruptive Technologies

Frequently Take a Forcing Function

Technology	Approximate Date Of First Lab Demo	Approximate Date of First Military Applications	
Radio	1901	1914	
Airplane	1903	1916	
Vacuum Tube	1906	1915	World War I
Mechanized Tank	1916	1916	
Liquid-Fueled Rockets	1922	1944	
Radar*	1925	1939	
Gas Turbine*	1935	1944	
Digital Computer*	1943	1945	World War II
Ballistic Missile*	1944	1945	
Nuclear Weapons*	1945	1945	
Transistor*	1948	1957	
Inertial Navigation*	1950	1955	
Nuclear Propulsion*	1950	1954	
Artificial Earth Satellites*	1957	1960	
Integrated Circuit*	1960	1970	Cold War
Laser*	1961	1967	
Precision Weapons*	1965	1967	
AI Expert System*	1965	1990	

U.S. and Worldwide Research Base Since WWII



Source: Report of the Defense Science Board Task Force on the Technology Capabilities of Non-DoD Providers; June 2000; Data provided by the Organization for Economic Cooperation and Development & National Science Foundation

A National Issue

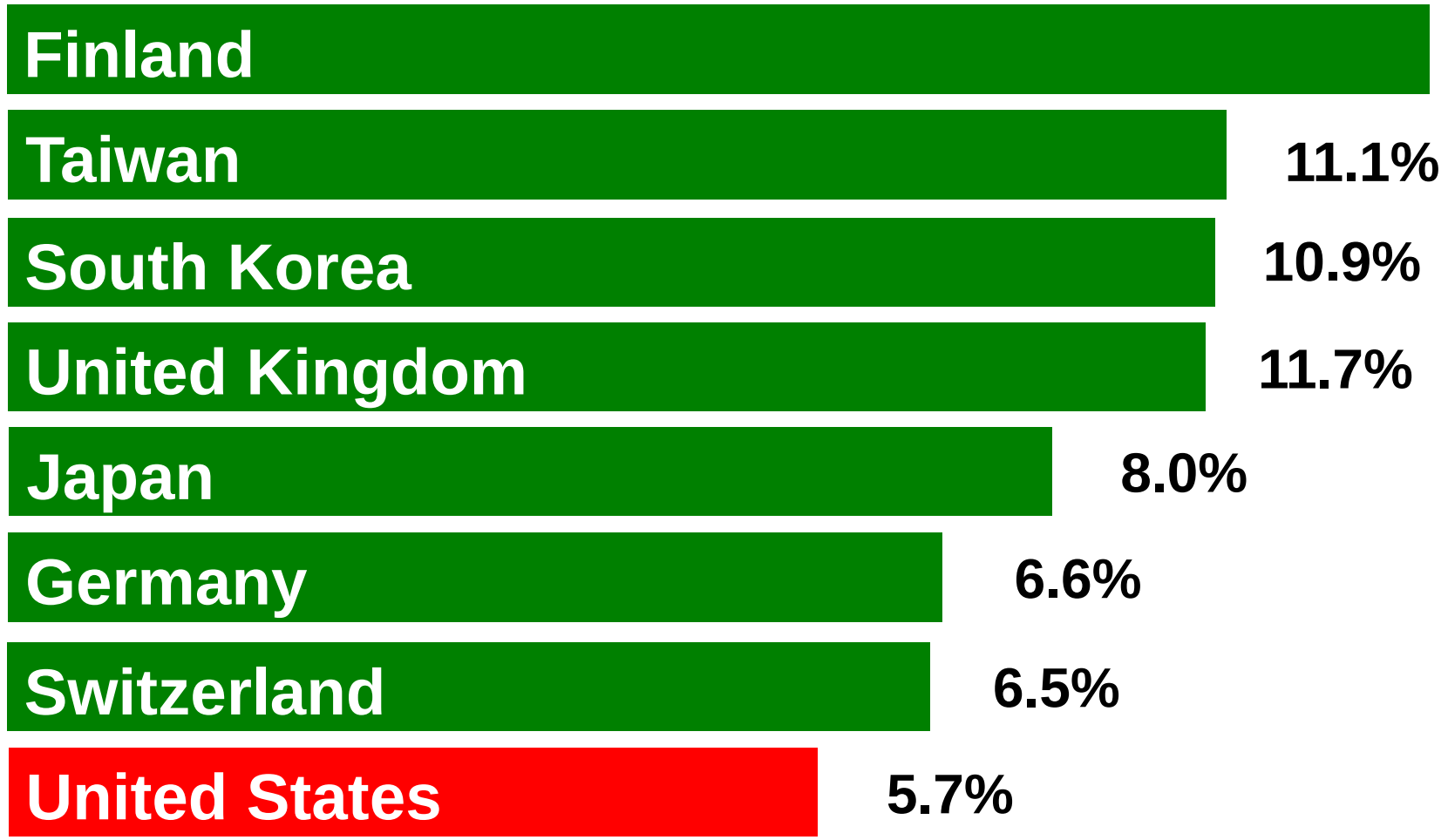
- "An Emerging and Critical Problem of the Science and Engineering Workforce"[1]
  - 12 Major studies (1999-2004) make essentially the same point
  - A few studies did not consider security clearance needs and rely on relaxation of immigration rules

- Growing need for U.S. citizens in national security activities

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1. National Science Board Companion Paper to "National Science and Engineering Indicators 2004", National Science Foundation, April 2004

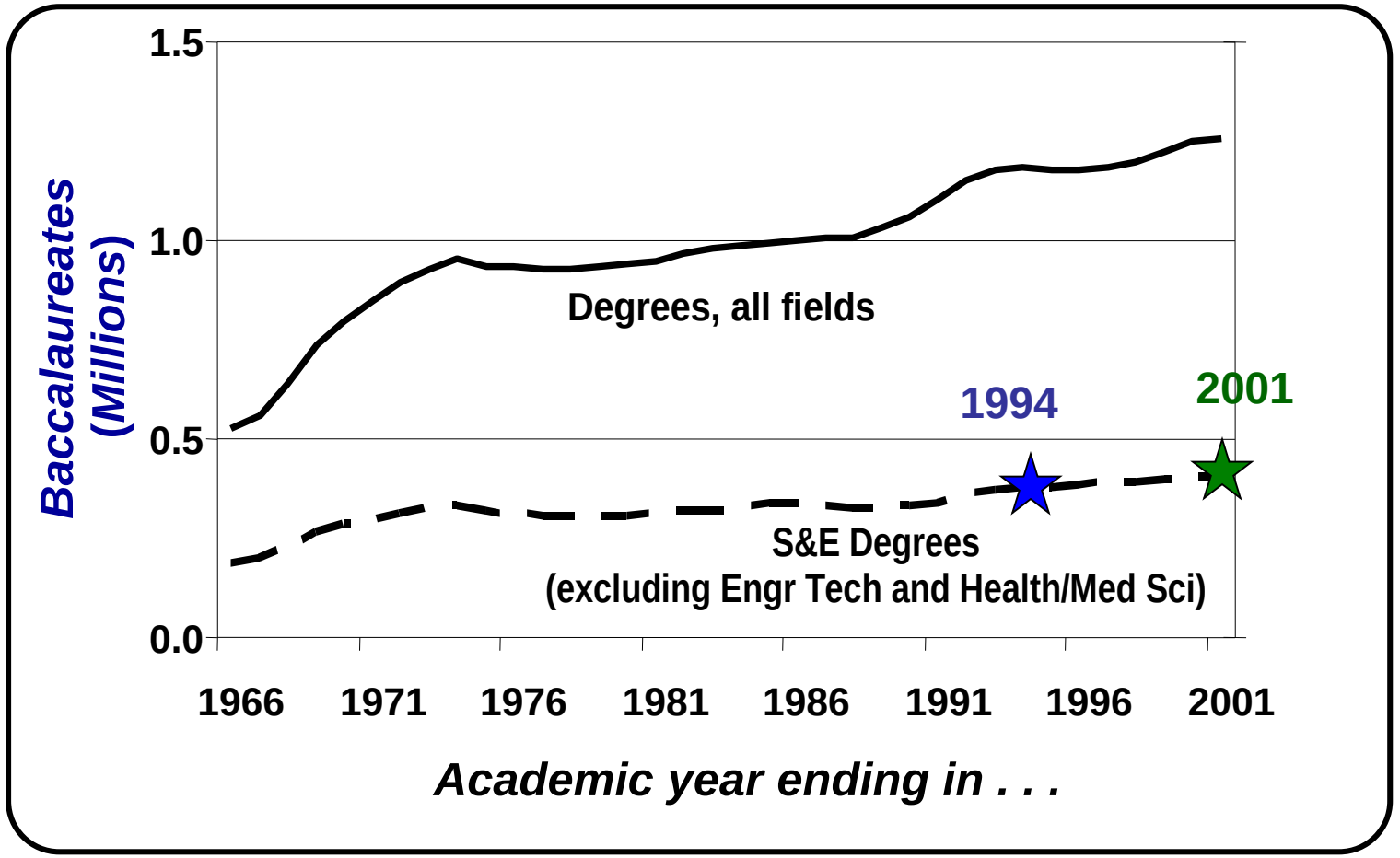
Percentage of 24-year-olds with a Science or Engineering Degree



Source: Money Magazine, Oct 2004, pg 124

U.S. Production of S&E Graduates*

U.S. College and University Graduates, 1966-2001



**Source: Data provided by the NSF, September 2003*

U.S. University Trends in Defense-Related S&E *Graduate Student Enrollment (1994-2001)*

**Source: National Science Foundation – Graduate Students and Post Doctorates in Science and Engineering: Fall 2001*

Science Disciplines

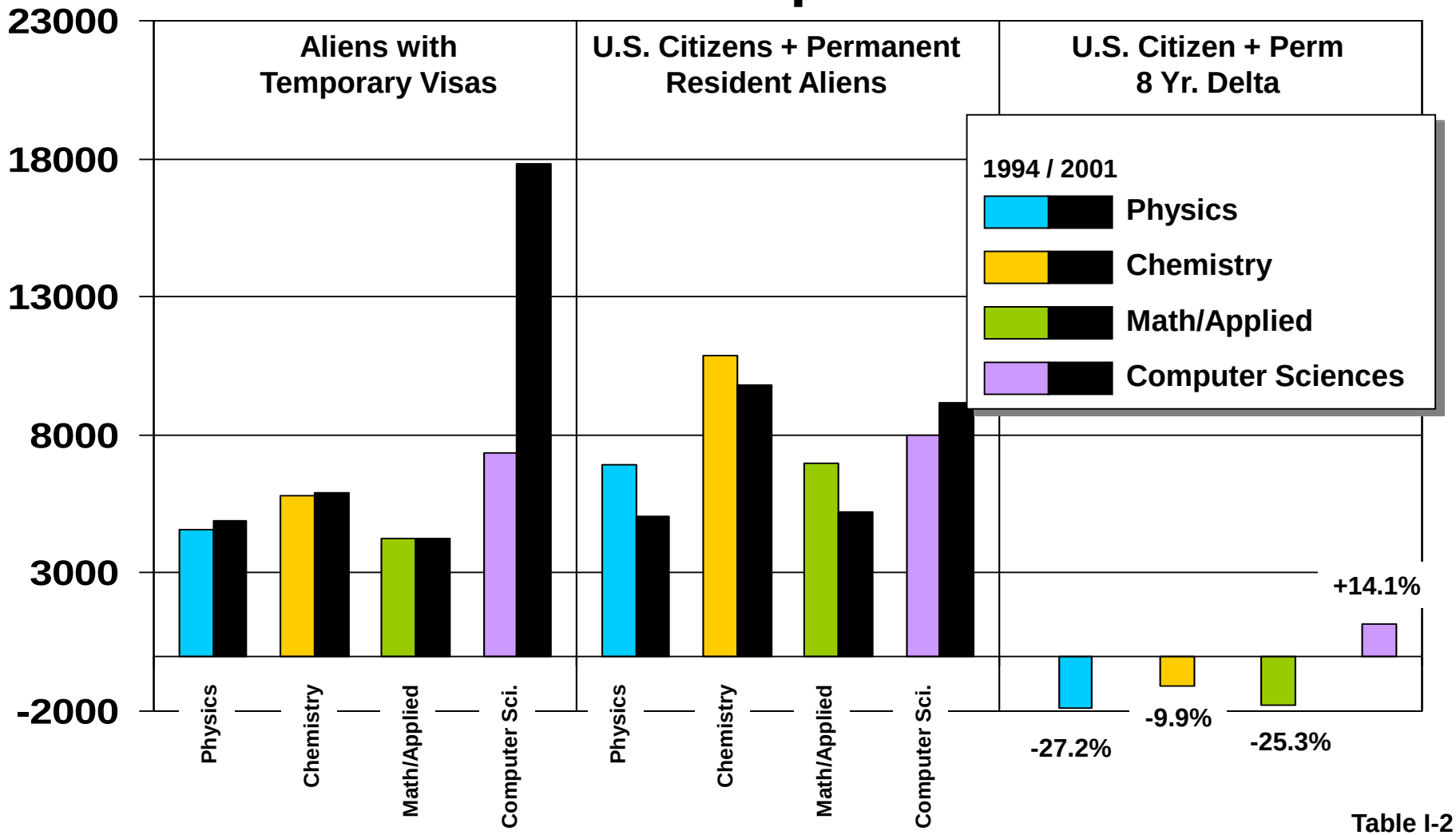
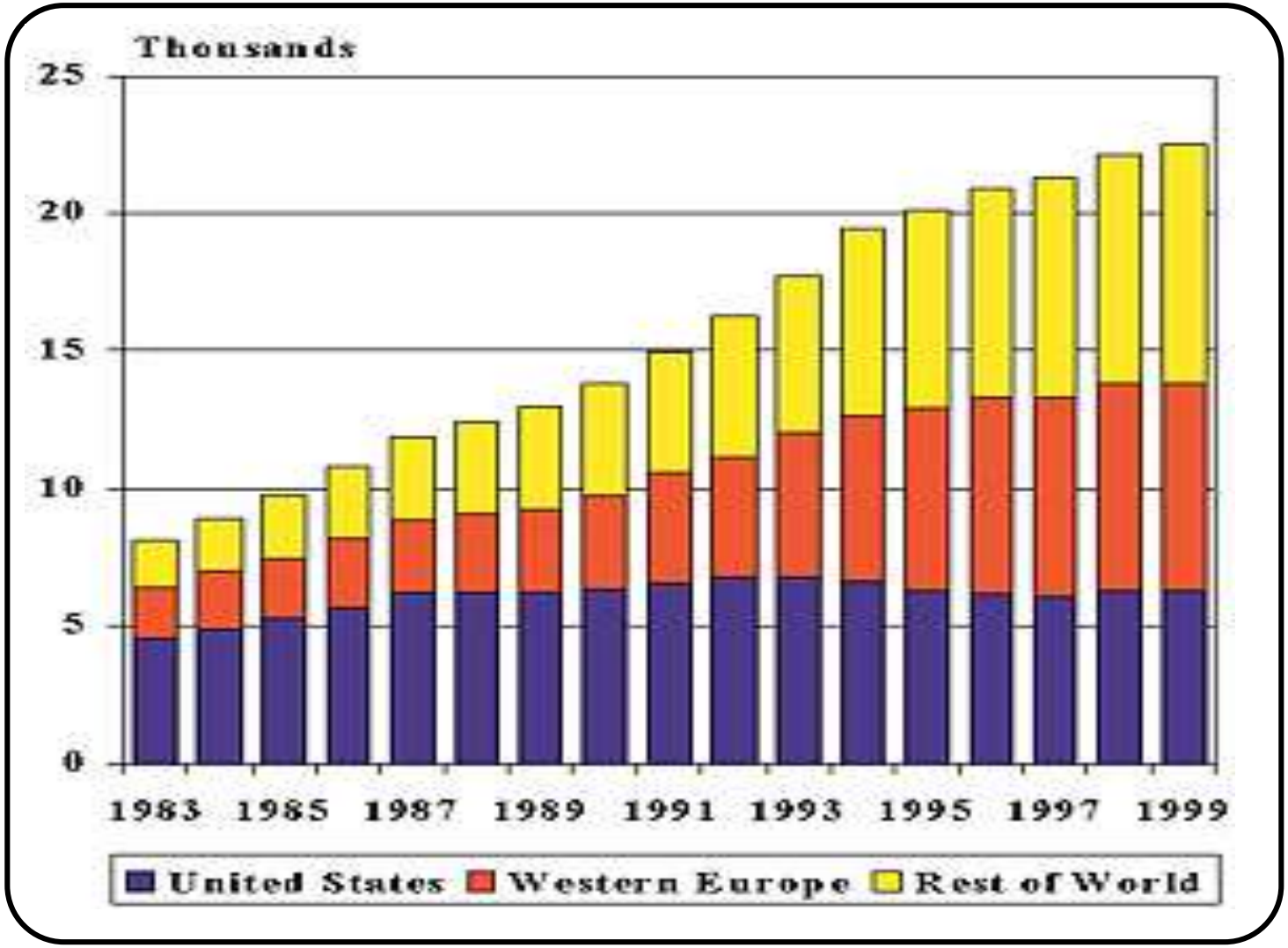


Table I-2

Physical Review Trends

Physical Review & Physical Review Letters

Total Submissions



Source: American Physical Society - *APS News August/September 2000*

Security Environment: 4 Challenges

Irregular

- Unconventional methods adopted by non-state and state actors to counter stronger state opponents.
- (e.g., terrorism, insurgency, civil war, and emerging concepts like "unrestricted warfare")

Catastrophic

- Surreptitious acquisition, possession, and possible employment of WMD or methods producing WMD-like effects against vulnerable, high-profile targets by terrorists and rogue states. *(paralyze our power)*
- (e.g., homeland missile attack, proliferation from a state to a non-state actor, devastating WMD attack on ally)

Traditional

- Military capabilities and military forces in long-established, well-known forms of military competition and conflict.
- (e.g., conventional air, sea, land forces, and nuclear forces of established nuclear powers)

Disruptive

- International competitors developing and possessing breakthrough technological capabilities intended to supplant U.S. advantages in particular operational domains. *(marginalize our power)*
- (e.g., sensors, information, bio or cyber war, ultra miniaturization, space, directed-energy, etc)

Higher

Lower

VULNERABILITY

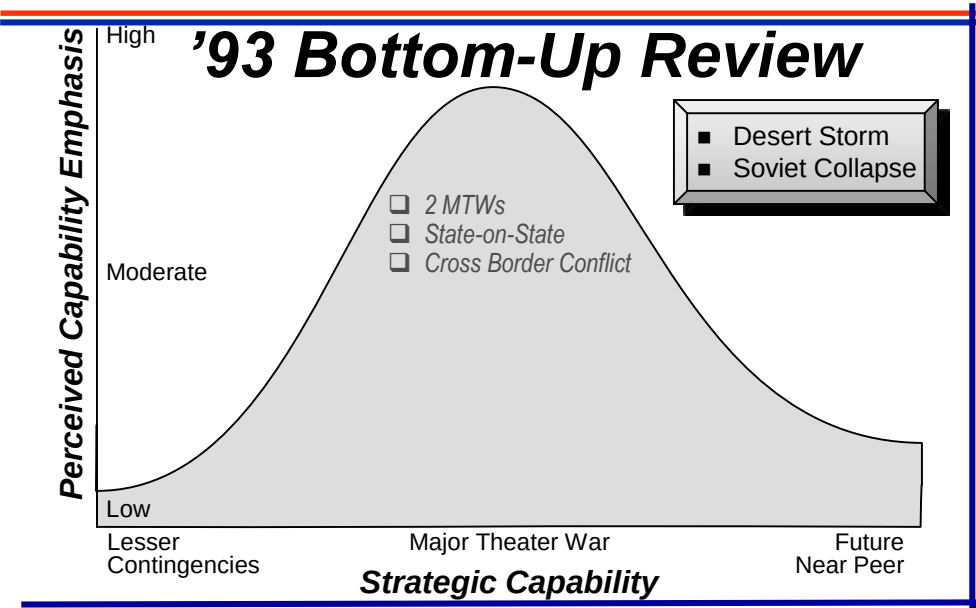
Lower

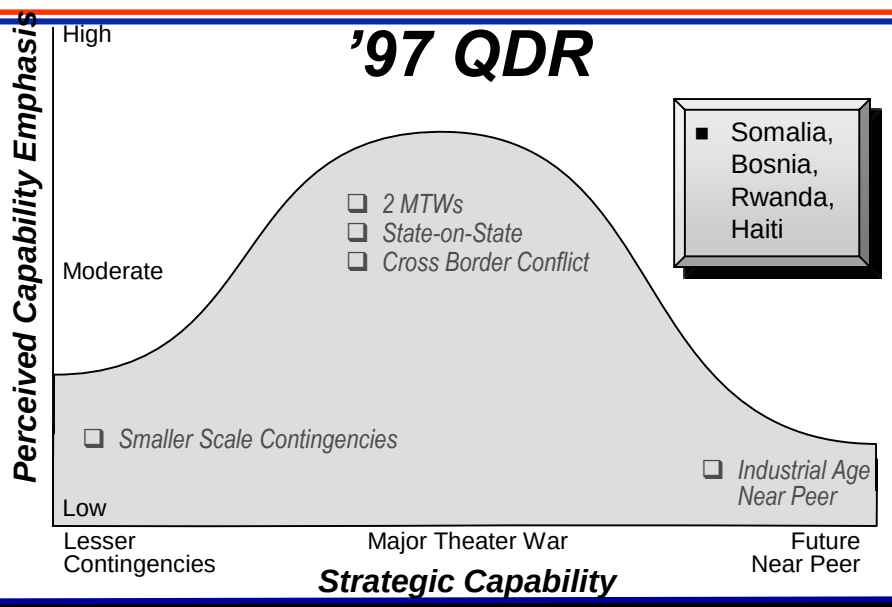
Higher

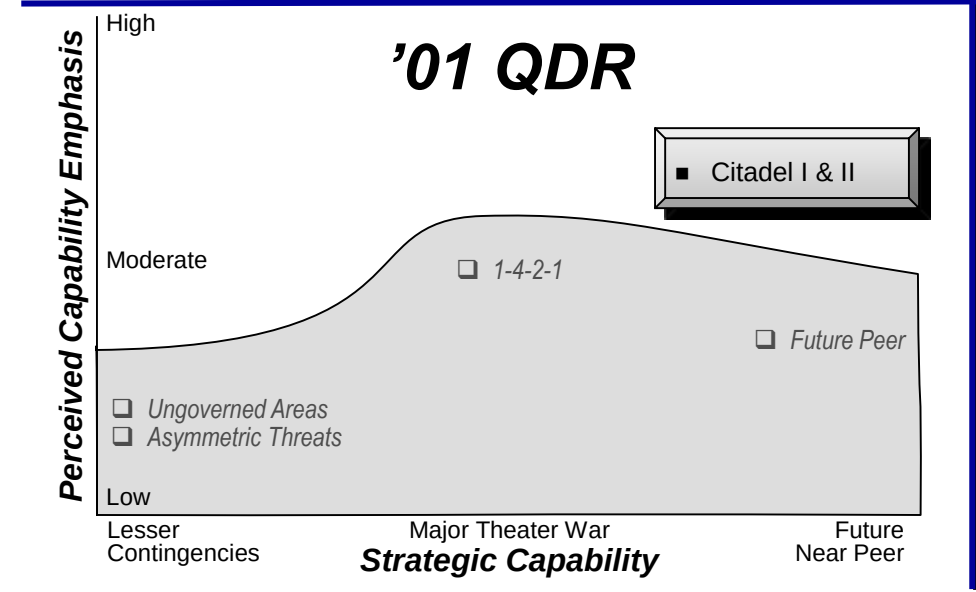
LIKELIHOOD

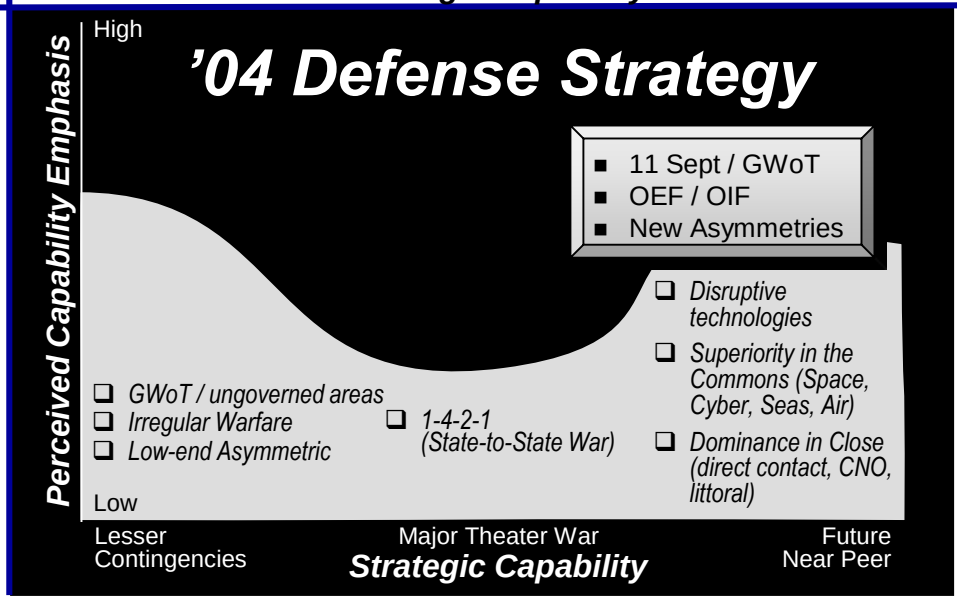
Capabilities-based planning should balance risk across challenges

Decade of Strategic Evolution









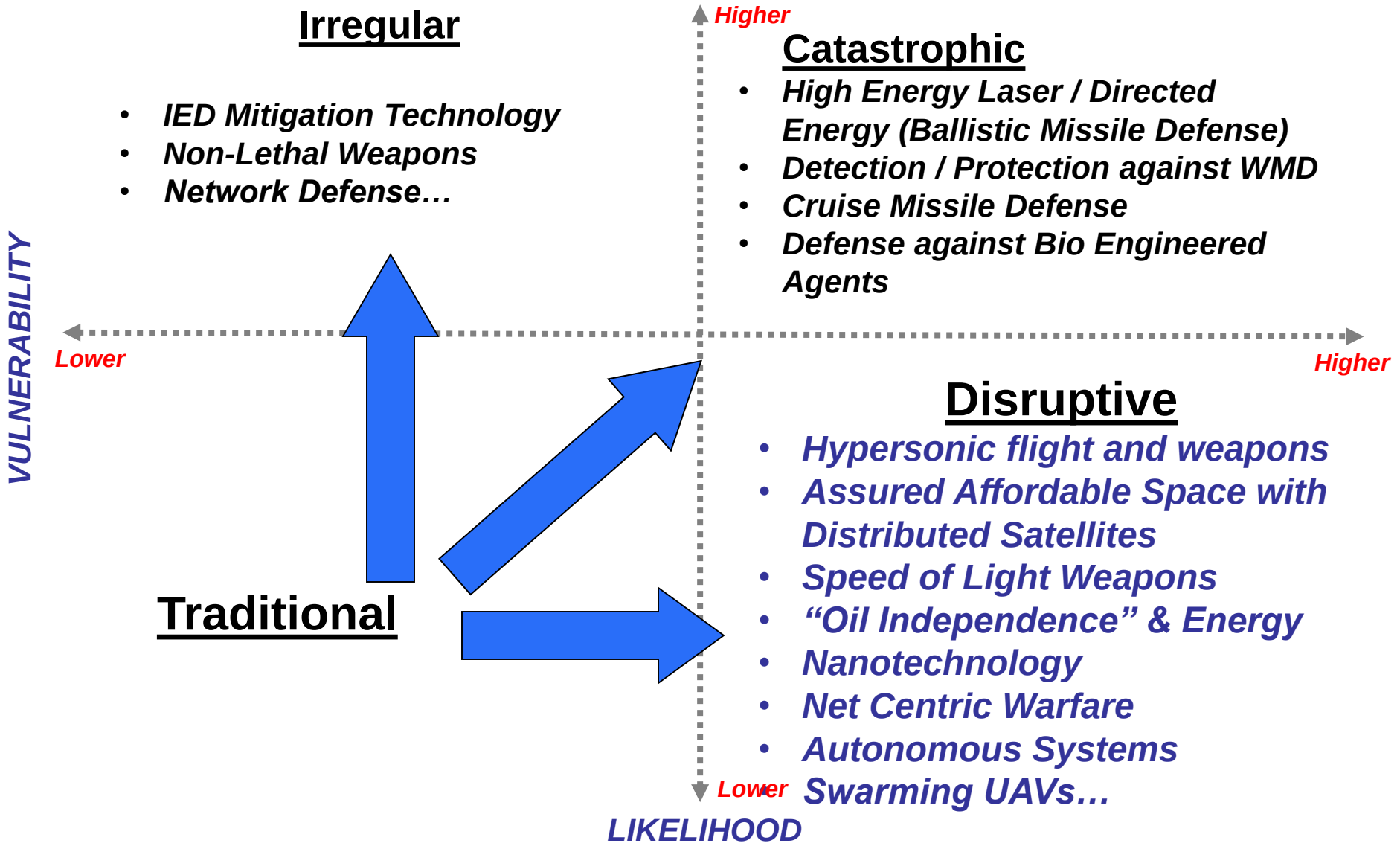
Disruptive Technology Dimensions
Attributes



- **Transformation Occurs With Leaps In Capabilities:**
  - **Manhattan Project—Lethality**
  - **Reconnaissance Satellites—Knowledge**
  - **Stealth—Agility**
  - **Ballistic Missiles—Speed**

Offensive Disruptive Technology is Transformational

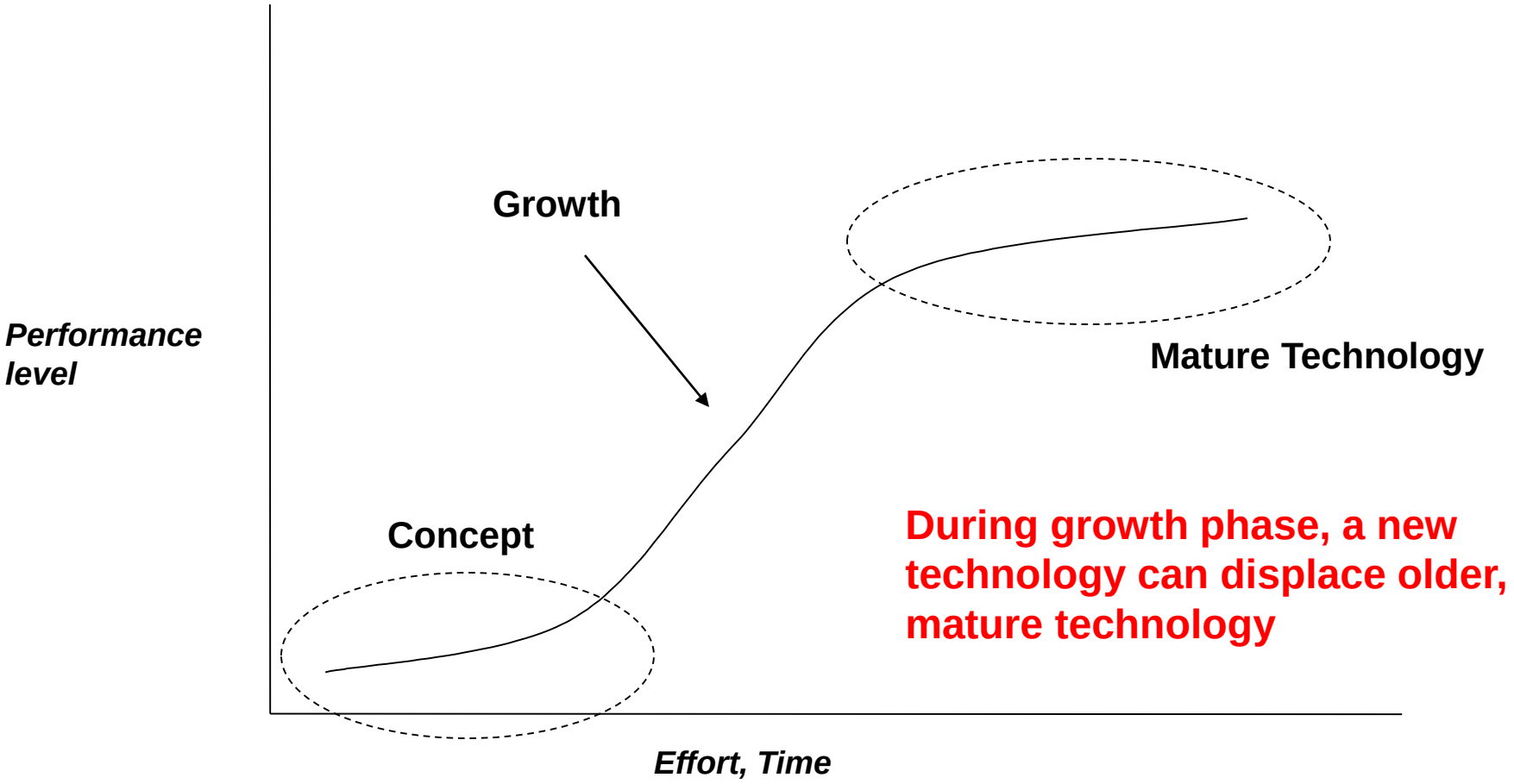
Security Environment: Strategy
S&T "Thrusts"



A Final Concept
Technology S-Curve

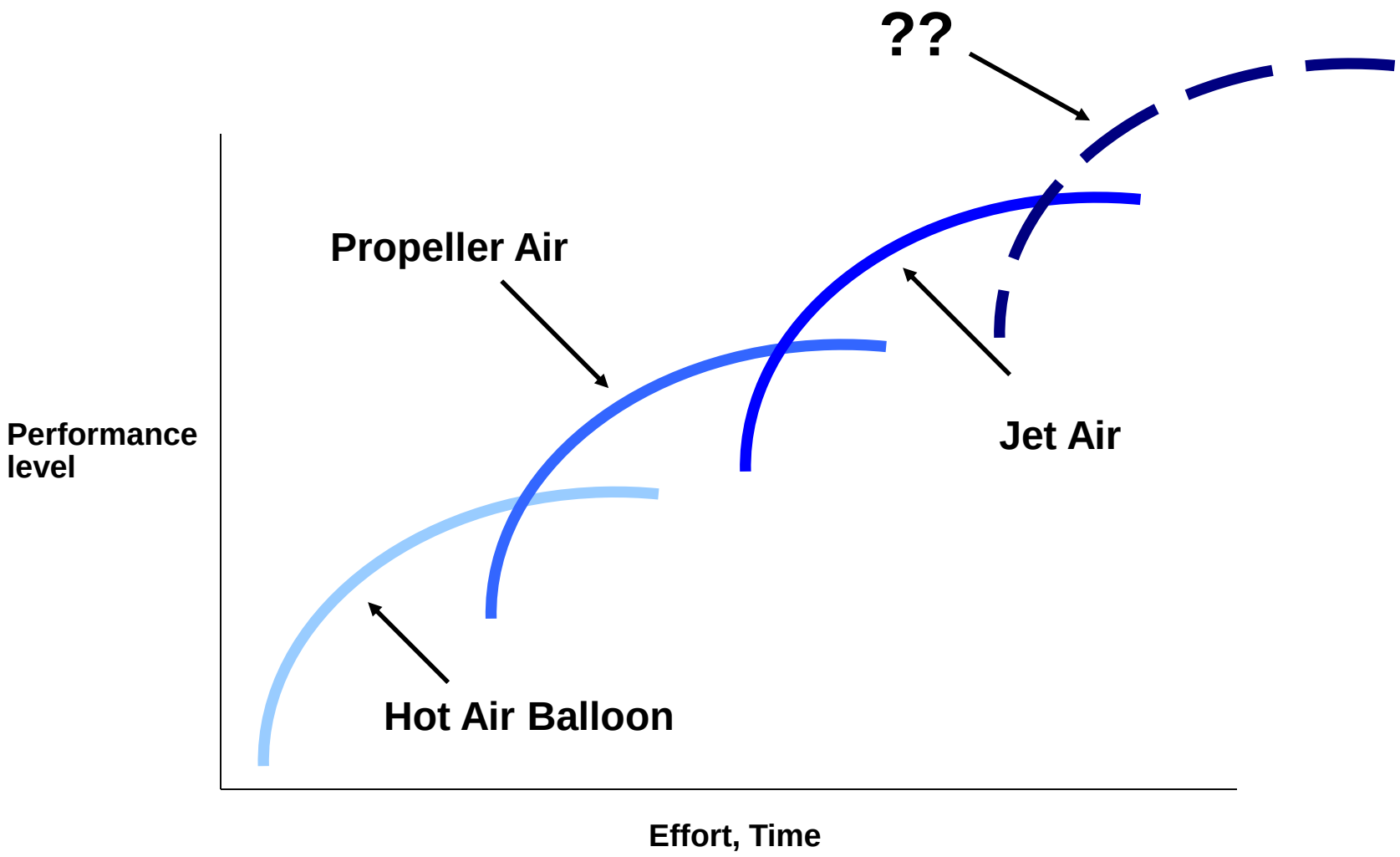
Most Technology maturation follows S-curve:

Initial Discovery, "Product-ization", then Incremental Improvement



Family of S-Curves

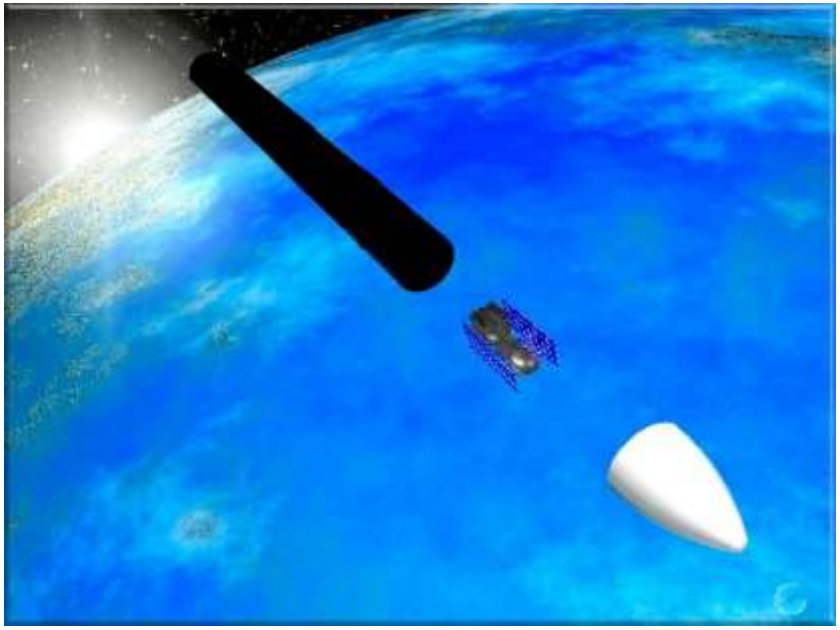
Military Aircraft



Falcon

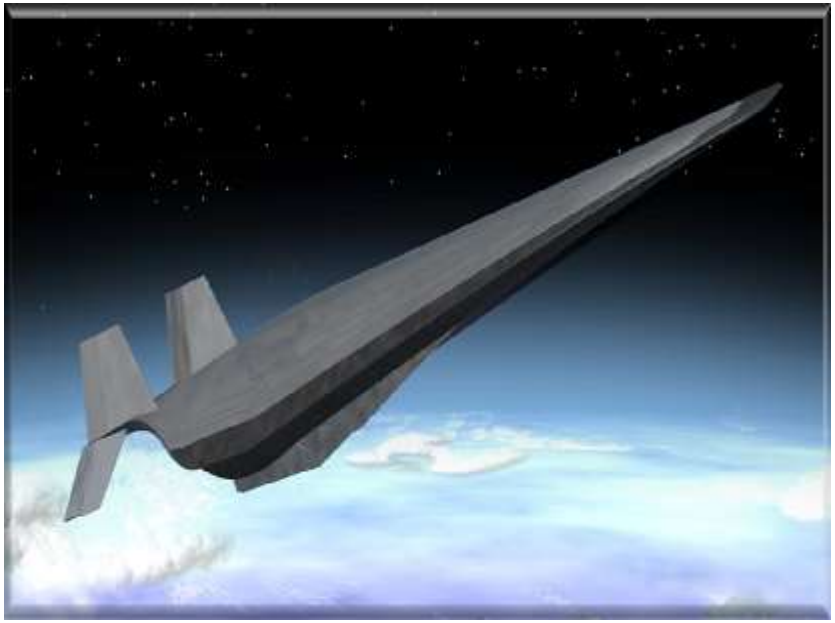
Near-Term Capability

Operationally Responsive Spacelift Capability



Far-Term Capability

Hypersonic Cruise Vehicle



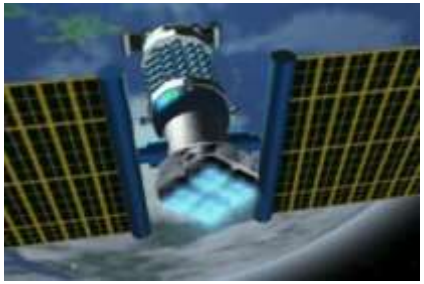
DARPA – Air Force Program

Propulsion Technology

Turbine Propulsion and Fuels Technology

• Engine Component Development • Demonstrator Engines • Fuels, Lubes, and Combustion





Rocket Propulsion Technology

• Rocket Engine and Fuel Technologies • Satellite Propulsion • Tactical and Ballistic Missile Propulsion

Advanced Propulsion Technology - *• Hypersonic Flight (Mach 4-8) Components • Scramjet Demonstrator Engines • Endothermic Fuels*

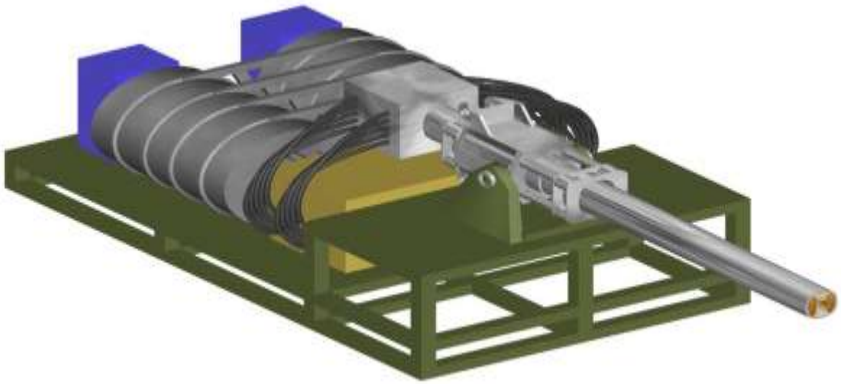




Aircraft and Weapon Power -

• Electrical Power Generation and Thermal Management for Aircraft • High Power Generation and Storage for Space and Directed Energy

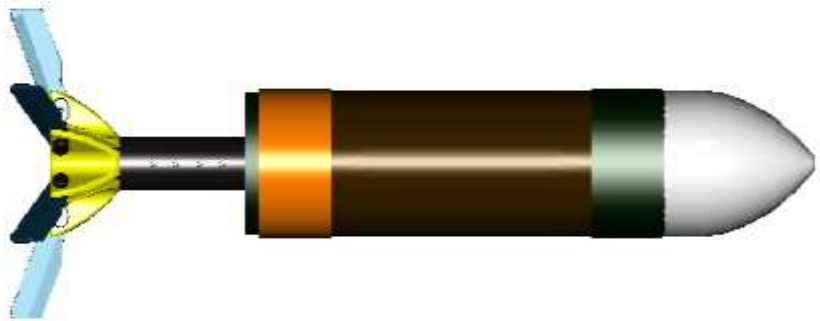
Electromagnetic Mortar (EM Mortar)





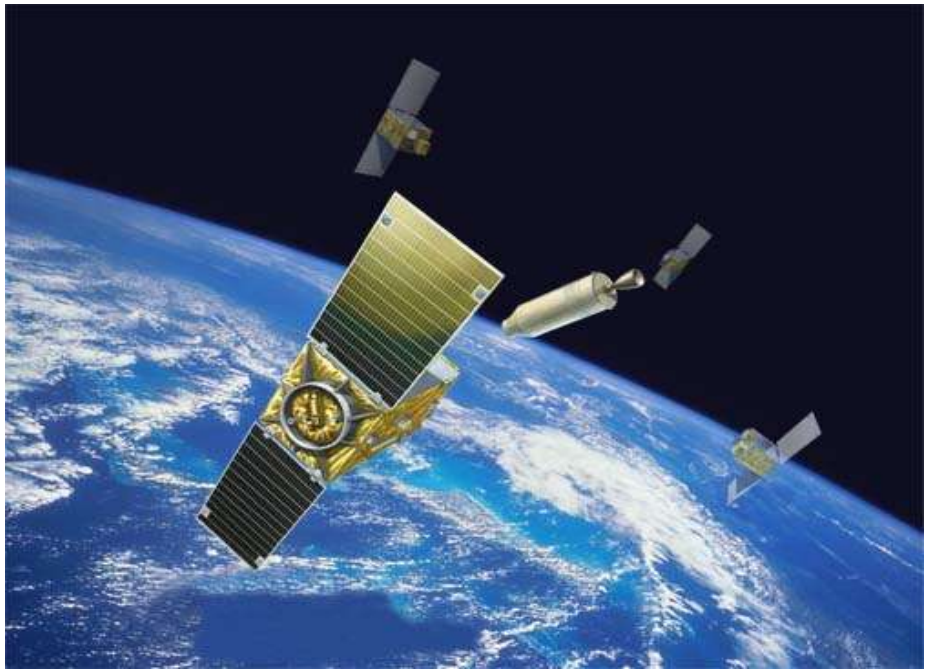
- Precision, lethality, fast response,

rapid strike, and versatility for artillery and sensor launch





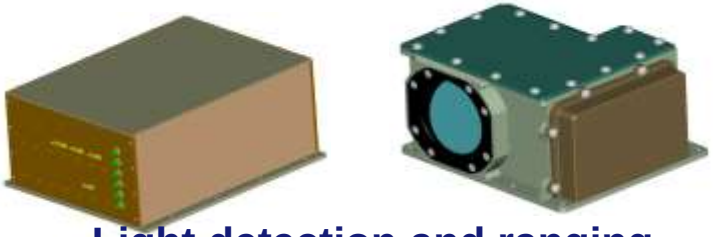
AF XSS-11



- **First demonstration of a fully autonomous satellite designed to demonstrate:**
  - **Software logic and algorithms to safely rendezvous and navigate around and inspect a resident space object**
  - **Mission planning, validation, verification tools, and operational tools and techniques**
  - **Collision avoidance—space situational awareness**



3u PCI Avionics

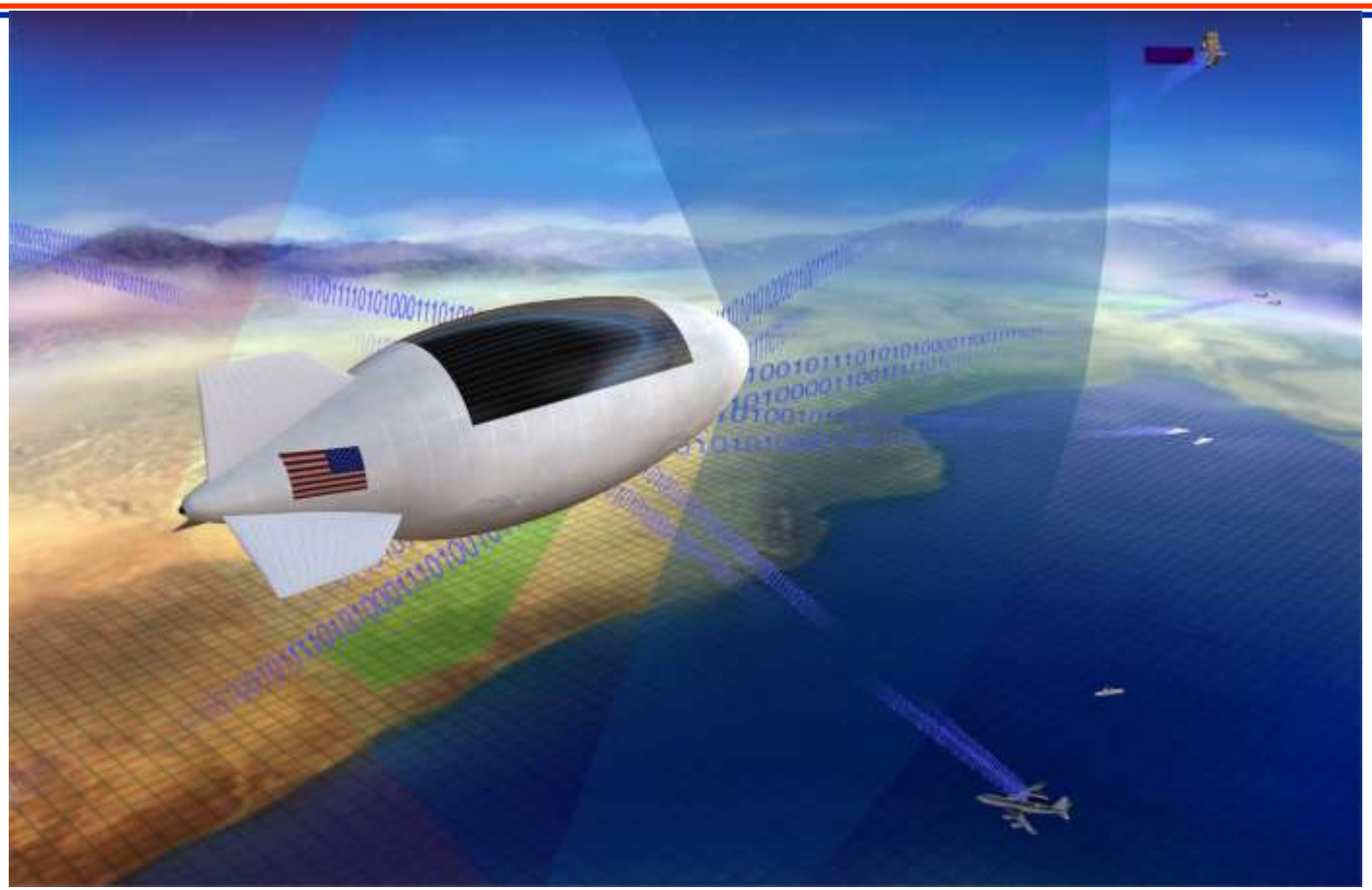


Light detection and ranging rendezvous system



Integrated imager and star camera

High Altitude Airship (HAA)



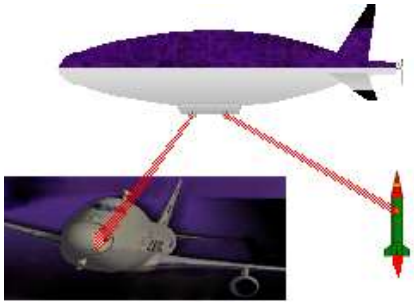
Transformational military capability; potential use as sensor, communications, and/or weapons platforms; demonstrator for future high altitude airships.

Directed Energy

Laser Devices and Analyses:

• Laser Devices - Photon Generators • Solid State and Chemical Lasers • Laser System Effects and Modeling





Laser Beam Control and Optics:

• Atmospheric Compensation/Beam Control Techniques to Get the Beam on Target to Do the Mission • Space Situational Awareness • Laser Communications

High Power Microwaves (HPM):

• Devices for Graduated Effects - Disrupt, Degrade, Damage, Destroy Electronics • Non-Lethal Long-Range Technologies

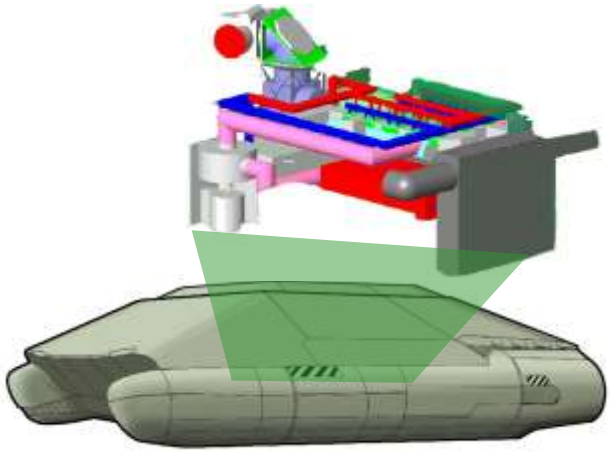


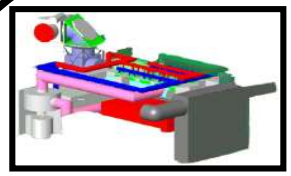
Effects at the Speed of Light

Lethality – Directed Energy

Solid State Laser Weapon

- SSL Weapon System Demonstrator for FCS





High Power Microwave (HPM) Enabling Technology

- High Power Electronics
- Antenna Technology

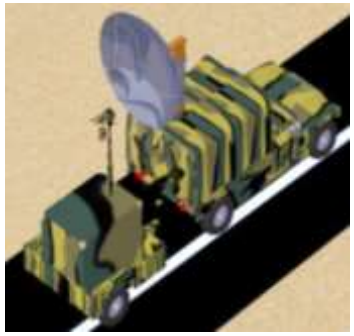
Solid State Laser (SSL)

- 25 kW/100 kW SSL Lab Demo
- SSL Weapon System Components
- 400 kW SSL Lab Demo (FY12)

HEL/Space Concepts

- Novel DEW Designs
- Space Control Concepts

Ground-based Mobile Electronic Attack

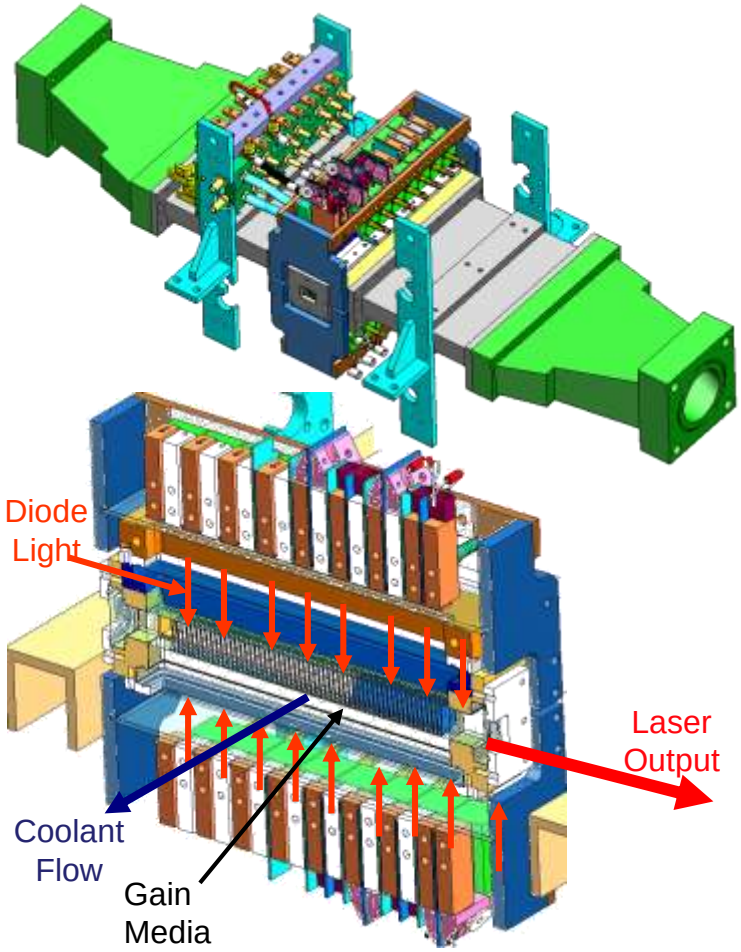


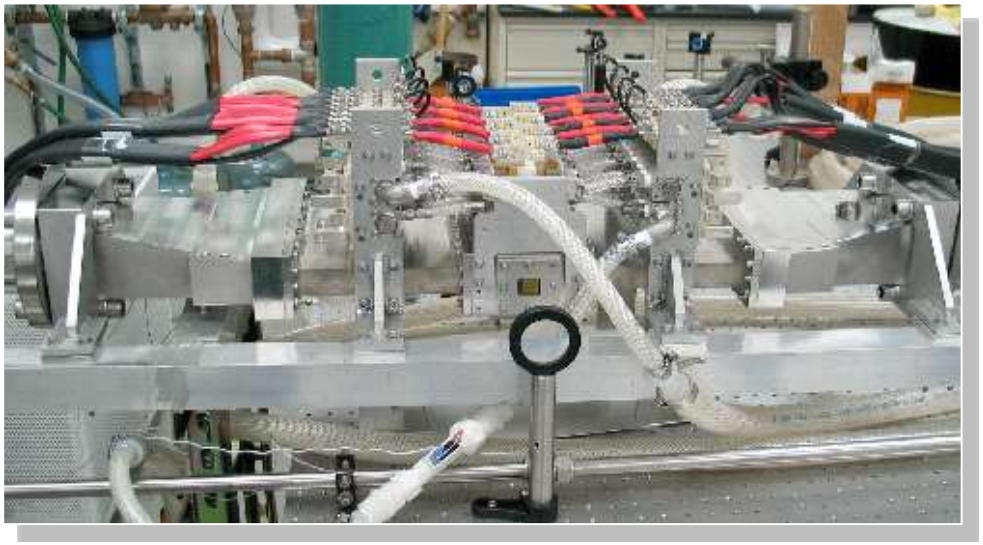
Rheostatic Pulsed Energy Weapon System

Advanced Laser Technology

- Novel Materials
- Beam Combining
- New Laser Configurations

Liquid Laser

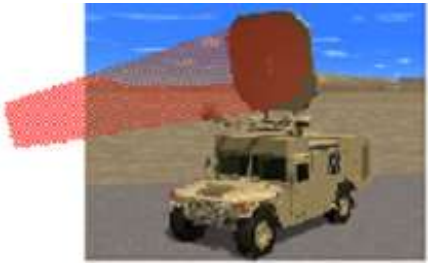




- ***Novel Design That Combines the Energy Density of a Solid State Laser with the Improved Thermal Management Qualities of a Liquid Laser***
- ***System Goals: 150 kW Laser Output, 5 kg/kW***
- ***Enables Laser Weapon Systems Integration with Tactical Platforms***

Airborne Active Denial

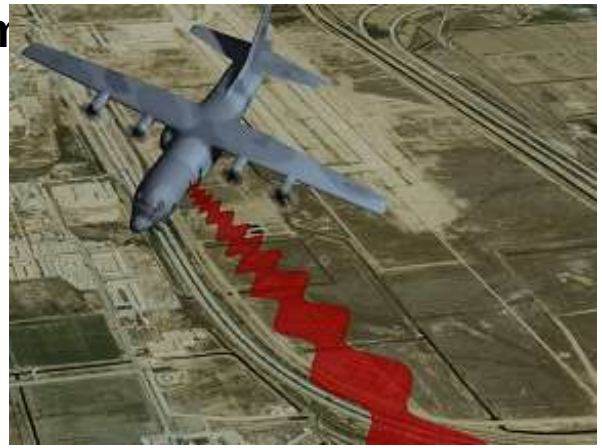
- Key technologies for airborne non-lethal anti-personnel directed energy weapon
- Non-lethal capability from operational altitudes
  - Deep magazine
  - Speed-of-light
  - Line-of-sight
- Energy beam heats adversary's skin
  - Causes intense pain
  - No damage
  - Forces adversary to flee



Ground Based ACTD

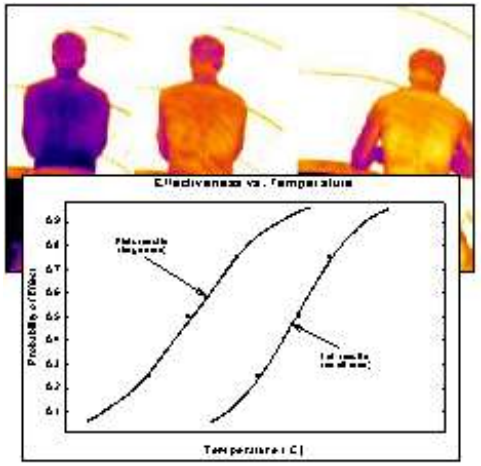


Advanced Gyrotrons





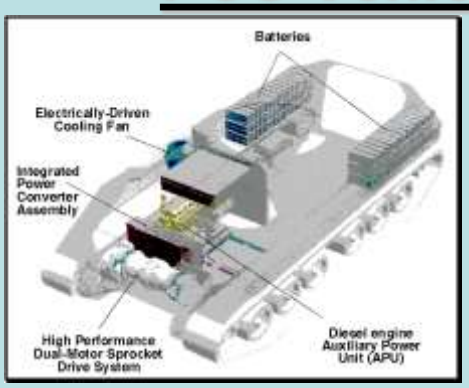
Electrical Power



Human Effects Validation

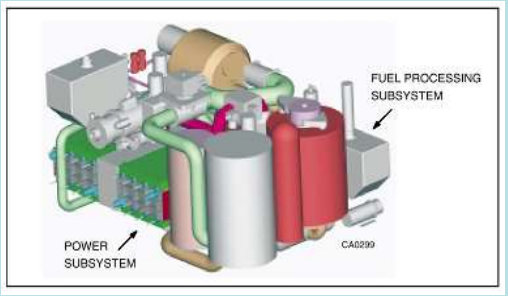
Power and Energy Technologies
FY06-11

FCS Vehicle Power



Hybrid Electric Drive

- *All Electric vehicles*
- *Fuel efficiency*
- *Silent mobility*



Diesel Reformer Power



Pulse Power for...
Electric Weapons & Protection
6x Power Density

- *Minimize deployment time*
- *Self Sustainment*
  - *3 days - High optempo*
  - *7 days - Low optempo*
- *New capabilities*
  - *Lethality*
  - *Survivability*

Soldier System Power

- *Reduce weight*
- *Increased power*
- *Increased mission time*

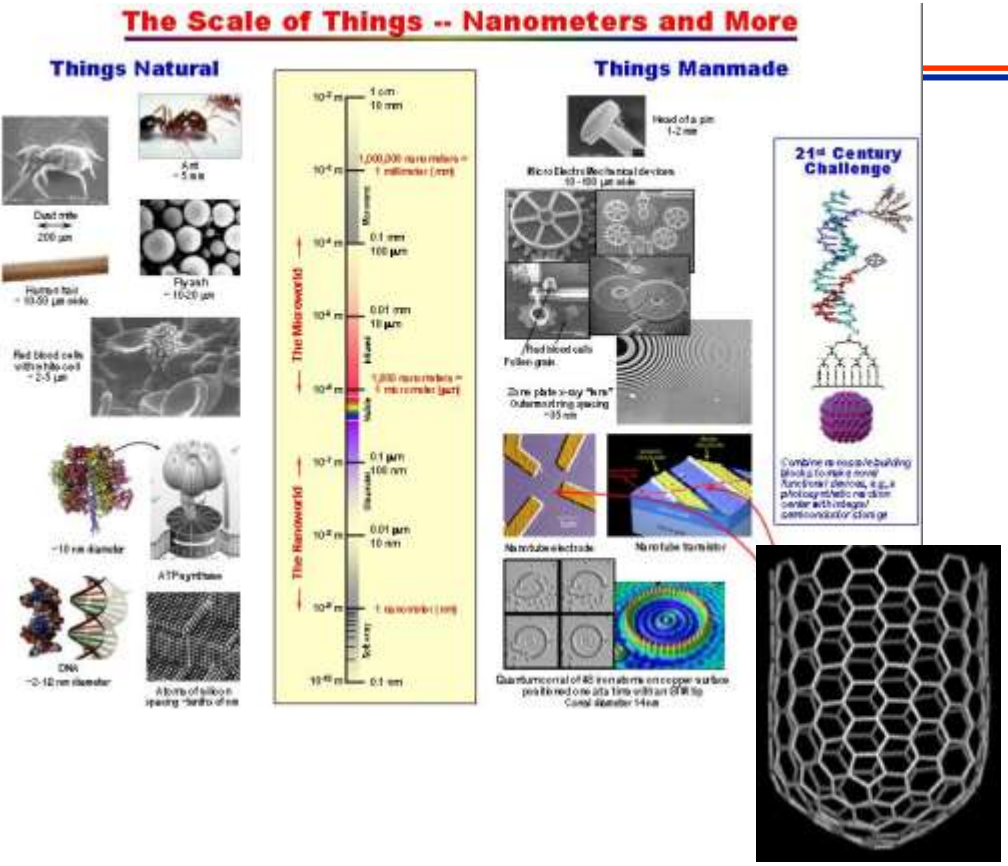




Microturbine/
Microengines

10x Power Density

Single-Wall Carbon Nanotubes



Objective:

SWNT's are the strongest and the best thermal materials known to man.

Robust program will demonstrate technologies for scaleable production, processing and manufacturing of SWNT's

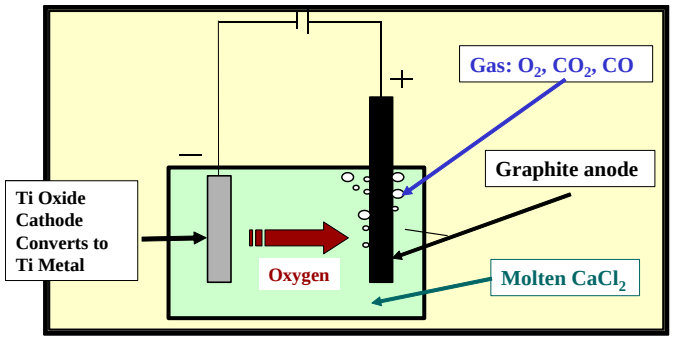
Payoff:

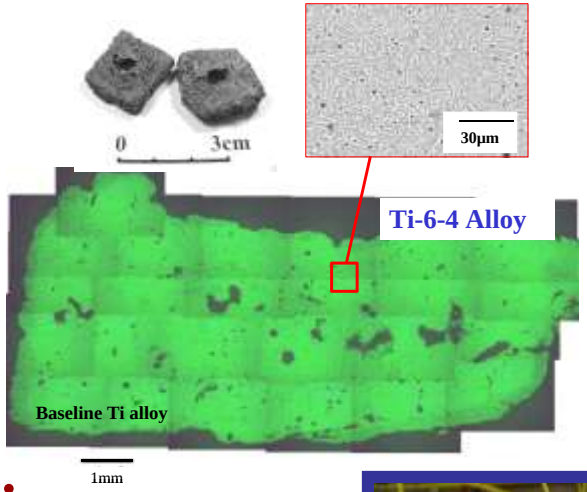
- **Light, Strong power/signal harnesses**
- **Light, high power density motors**
- **Thermal management/heat pipes**
- **Regenerable CO_2 scrubbers**
- **Fuel cells**
- **Photovoltaics/themophotovoltaics**

Single-Wall Carbon Nanotube (SWNT)

Property	SWNT	Copper	Aluminum
Conductivity	10^4-10^7mho	5x10^5mho	3.8x10^5 mho
Weight	1.4 g/cc	8.9 g/cc	2.7 g/cc
Stability	inert to 500C	corrodes	surface oxide
Thermal Expansion	-2 ppmC^{-1}	-16 ppmC^{-1}	23 ppmC^{-1}
Thermal Conductivity	20-2000 $Wm^{-1}K^{-1}$	400 Wm-1K-1	116-235 Wm-1K-1
Tensile Strength	5-20 GPa	0.4-1.5 GPa	0.1-0.6 GPa

Low Cost Titanium

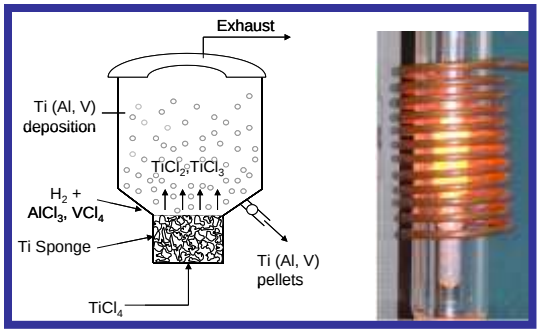




- **Several competitive routes being examined:**
  - **Electrolytic**
  - **Fluidized Bed**
  - **Na Reduction**
- **Target: < $4/lb**



Cost estimates as low as $1.00-$2.50/lb



DoD Needs
One More "Transformation"

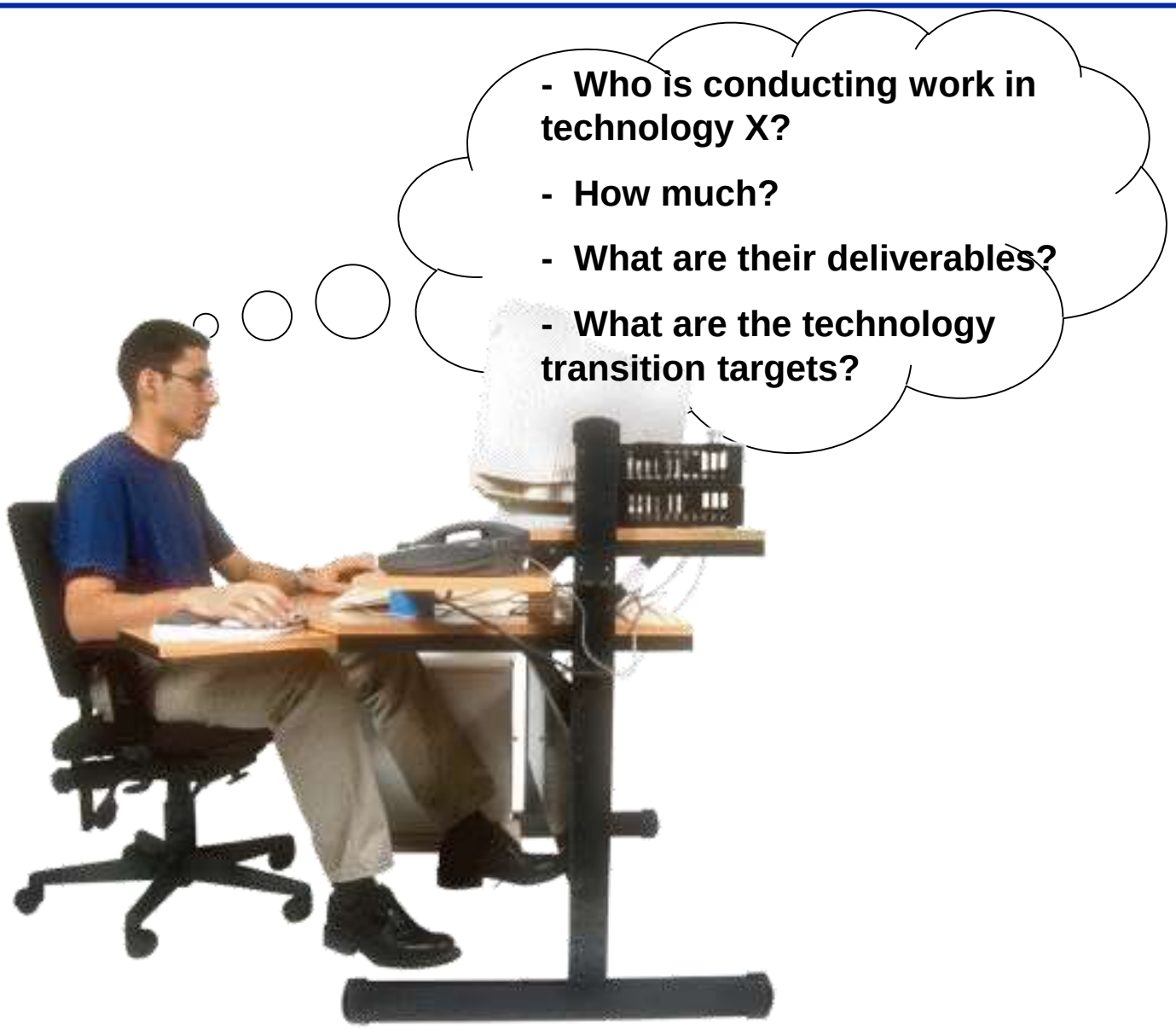
The Information Transformation

Every DoD Researcher, Acquisition Professional, Tester, and Operator should be able to sit down at their Desktop computer and be able to find out:

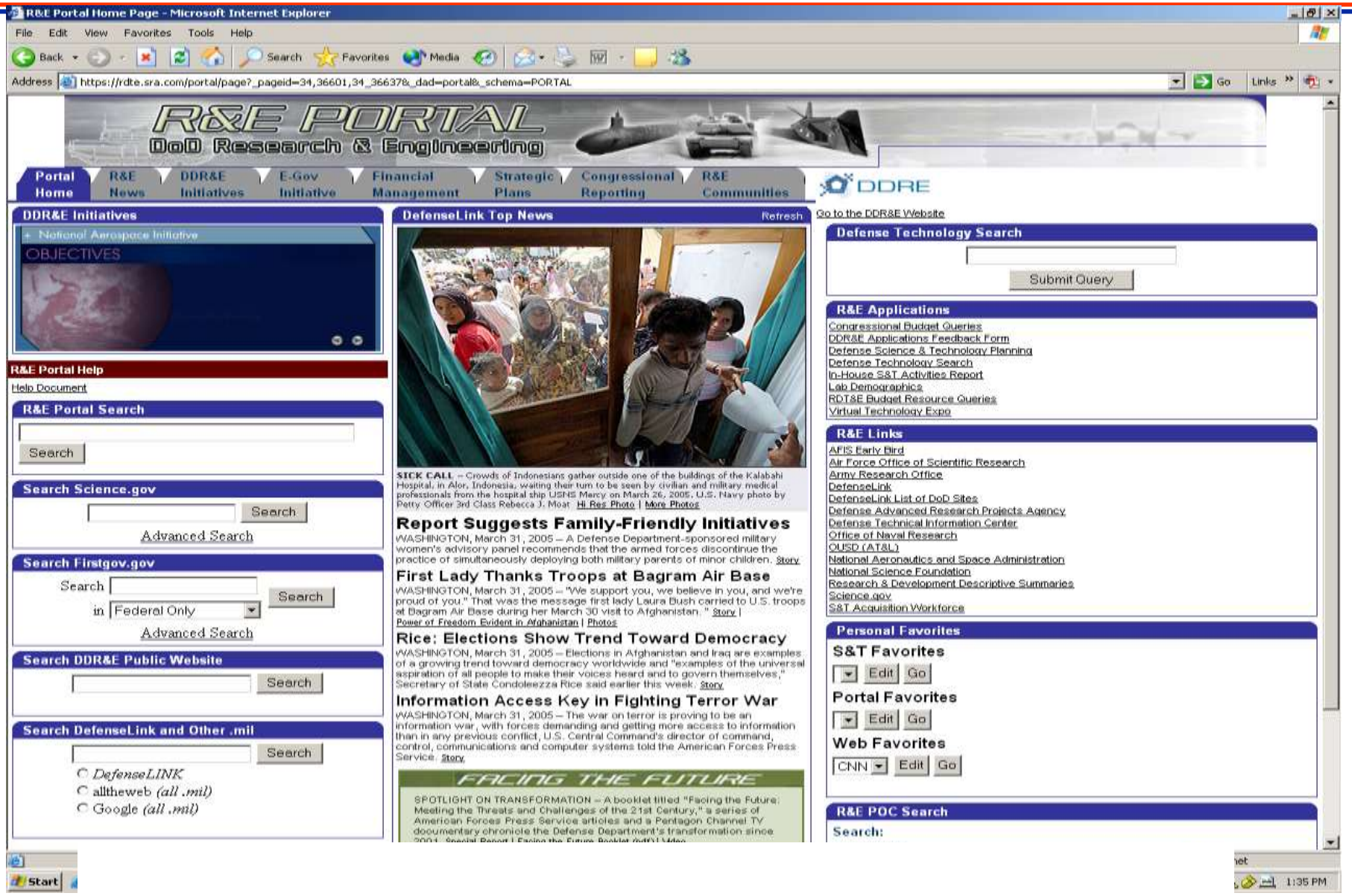
- **What the DoD is doing in R&E**
- **Why we are doing the work**
- **When the work will be done**
- **Who knows more about this information**

"Smarter Google" for the RDT&E and Warfighter Community

The Vision


- Who is conducting work in technology X?
- How much?
- What are their deliverables?
- What are the technology transition targets?

R&E Portal


R&E Portal Home Page - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address https://rdte.sra.com/portal/page?_pageid=34,36601,34_366378&_dad=portal&_schema=PORTAL
Go Links
R&E PORTAL
DoD Research & Engineering
Portal Home
R&E News
DDR&E Initiatives
E-Gov Initiative
Financial Management
Strategic Plans
Congressional Reporting
R&E Communities
DDRE
Go to the DDR&E Website
DDR&E Initiatives
National Aerospace Initiative
OBJECTIVES
R&E Portal Help
Help Document
R&E Portal Search
Search
Search Science.gov
Search
Advanced Search
Search Firstgov.gov
Search
in Federal Only
Search
Advanced Search
Search DDR&E Public Website
Search
Search DefenseLink and Other .mil
Search
DefenseLINK
alltheweb (all .mil)
Google (all .mil)
DefenseLink Top News
Refresh
SICK CALL – Crowds of Indonesians gather outside one of the buildings of the Kalabahi Hospital, in Alor, Indonesia, waiting their turn to be seen by civilian and military medical professionals from the hospital ship USNS Mercy on March 26, 2005. U.S. Navy photo by Petty Officer 3rd Class Rebecca J. Moat Hi Res Photo | More Photos
Report Suggests Family-Friendly Initiatives
WASHINGTON, March 31, 2005 – A Defense Department-sponsored military women's advisory panel recommends that the armed forces discontinue the practice of simultaneously deploying both military parents of minor children. Story
First Lady Thanks Troops at Bagram Air Base
WASHINGTON, March 31, 2005 – "We support you, we believe in you, and we're proud of you." That was the message first lady Laura Bush carried to U.S. troops at Bagram Air Base during her March 30 visit to Afghanistan. " Story | Power of Freedom Evident in Afghanistan | Photos
Rice: Elections Show Trend Toward Democracy
WASHINGTON, March 31, 2005 – Elections in Afghanistan and Iraq are examples of a growing trend toward democracy worldwide and "examples of the universal aspiration of all people to make their voices heard and to govern themselves," Secretary of State Condoleezza Rice said earlier this week. Story
Information Access Key in Fighting Terror War
WASHINGTON, March 31, 2005 – The war on terror is proving to be an information war, with forces demanding and getting more access to information than in any previous conflict, U.S. Central Command's director of command, control, communications and computer systems told the American Forces Press Service. Story
FACING THE FUTURE
SPOTLIGHT ON TRANSFORMATION – A booklet titled "Facing the Future: Meeting the Threats and Challenges of the 21st Century," a series of American Forces Press Service articles and a Pentagon Channel TV documentary chronicle the Defense Department's transformation since
Defense Technology Search
Submit Query
R&E Applications
Congressional Budget Queries
DDR&E Applications Feedback Form
Defense Science & Technology Planning
Defense Technology Search
In-House S&T Activities Report
Lab Demographics
RDT&E Budget Resource Queries
Virtual Technology Expo
R&E Links
AFIS Early Bird
Air Force Office of Scientific Research
Army Research Office
DefenseLink
DefenseLink List of DoD Sites
Defense Advanced Research Projects Agency
Defense Technical Information Center
Office of Naval Research
OUSD (AT&L)
National Aeronautics and Space Administration
National Science Foundation
Research & Development Descriptive Summaries
Science.gov
S&T Acquisition Workforce
Personal Favorites
S&T Favorites
Edit Go
Portal Favorites
Edit Go
Web Favorites
CNN Edit Go
R&E POC Search
Search:
Start
1:35 PM

Summary

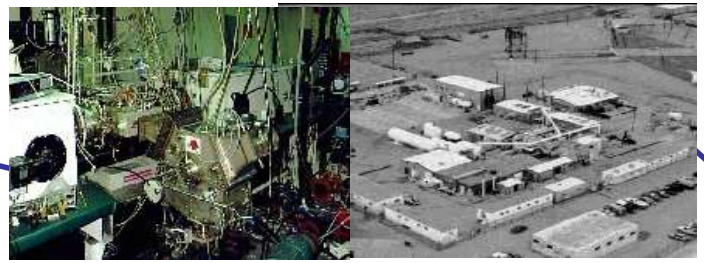
- **Understanding Disruptive Technologies are vital to continued competitive stature**
- **With Increased Knowledge in Rest of World, Pace of Technology, Potential for Technology Surprise Increasing**
- **Need to stay engaged with rest of world to minimize “surprise”**

Backup Slides

S&T Can Take Time for Transition



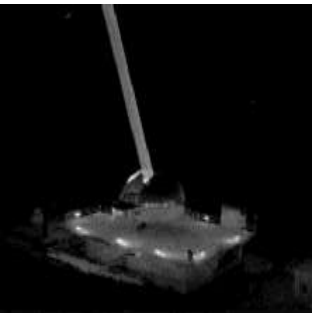
Adaptive Optics



Chemical Oxygen Iodine Laser

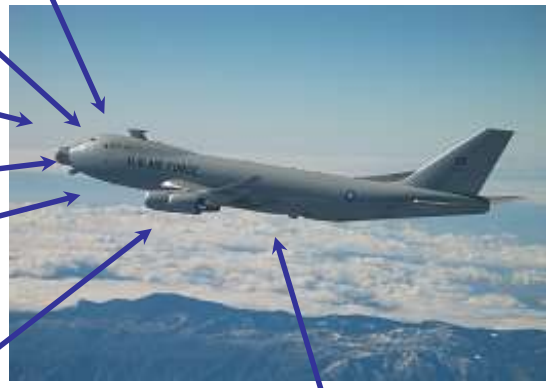


Airborne Laser Laboratory



1.5m Telescope

30+ Years of Air Force S&T investments in beam control and high energy lasers have made an ABL Possible





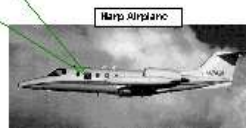
3.5m Telescope



Atmospheric Compensation





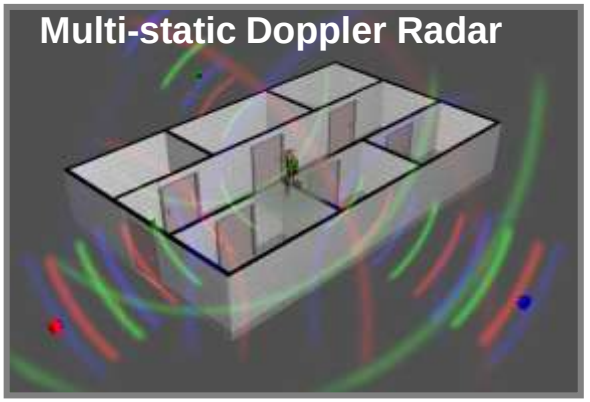


Atmospheric Measurements

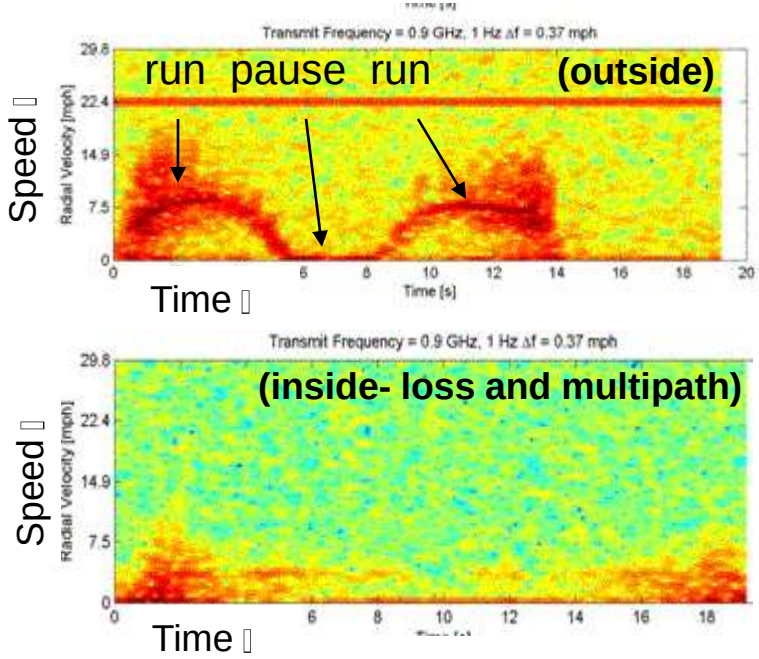
Through-the-Wall Imaging for Urban Operations

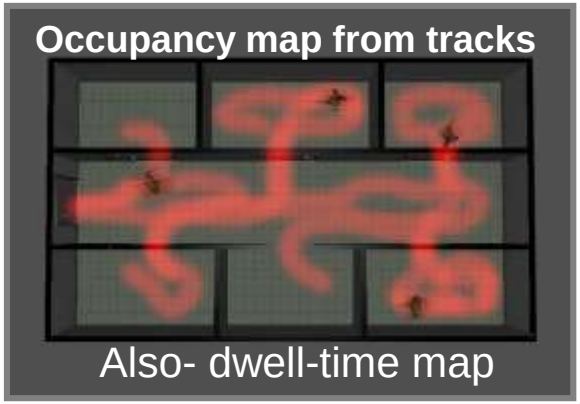
MTI Radar

- Strategic collection of threat activity patterns and building layout / door properties using exterior sensors
- Tactical detection and localization of adversaries or hostages inside building using exterior sensors



900 MHz Doppler Returns from walker:



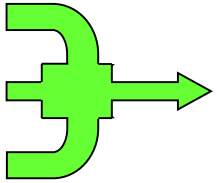


Counter-IED Thrust



- Recently launched (Feb 05) a focused counter-IED research program w/ NRL, University Affiliated Research Centers,etc
- Sustained BASIC Research investment: 10% NRL Base Program; matching ONR extramural funds (to universities, labs, industry, etc.)
- Investment on real-time detection of threat & advanced long-range destruction technologies
- “Feed” USMC CONOPS/Training
- Deliver Counter-IED S&T Roadmap to SECNAV

- Detection at a Distance
- Destruction at a Distance
- Defeat at a Distance



Deterrence

Army S&T Vision—
Pursuing Transformational Capabilities

Speed, Reach, and Precision

Current Force



~100 lb. load



70+ tons





< 10 mph

From Platforms to System of Systems

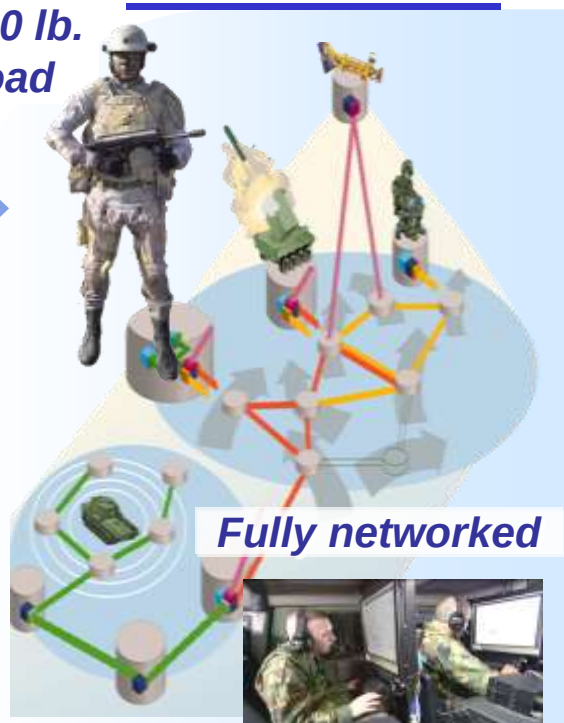
Enabling the Future Force



Enhancing the Current Force

Future Force

< 40 lb. load



Fully networked

< 20 tons



> 40 mph

Disruptive Technologies



Through Wall Sensing



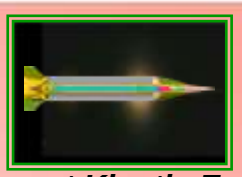
Network Mining



100kW Lab Laser Demo



Non-Line of Sight launch system



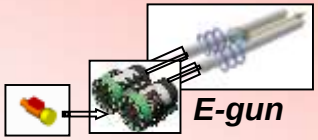
Compact Kinetic Energy Missile (CKEM)



Flexible Displays

ICB

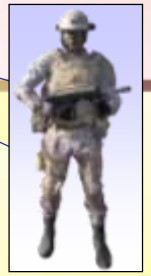




E-gun



HPM



FFW

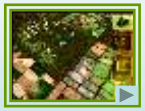


Autonomy



Active Protection





Full Spectrum Command

ict



Flatworld



Virtual Dilemma



Swarming

Net Centricity

Lethality

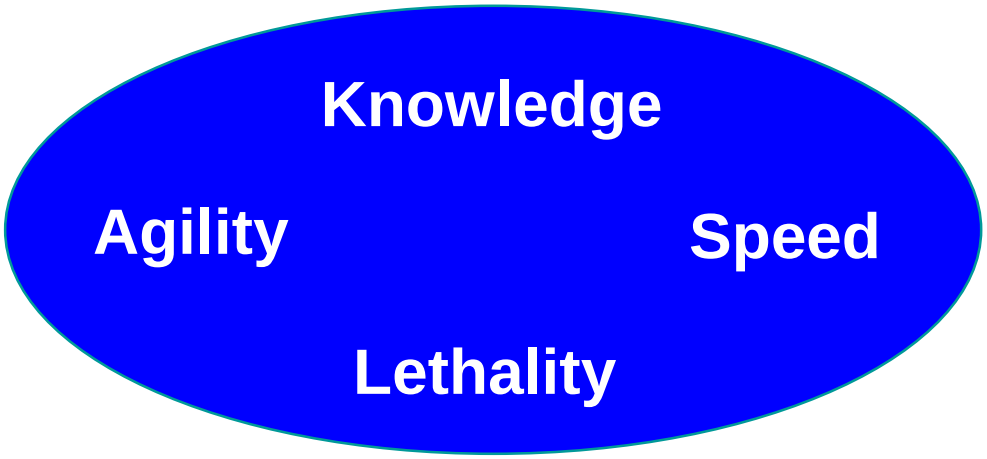
Survivability

Training

Robotics

Providing Strategically Responsive Forces with Information Dominance and Paradigm Shifting Lethality & Survivability

Technology and Transformation
Transformational Attributes



- DDR&E Transformation Technology Initiatives
  - National Aerospace Initiative
  - Surveillance and Knowledge Systems
  - Energy and Power Technologies

Traditional Systems Tend to be Mature

Conventional	Evolving To System	DDR&E Initiative
Air Systems →	Unmanned Systems, Hypersonics →	National Aerospace Initiative
Land Systems →	Future Combat System Objective Force (Army)	Energy & Power Technologies
Sea Systems →	Electric Ship	
	Directed Energy Weapons – Active Denial System – Airborne Relay Mirrors	
	Chem/Bio Defense – Genetic Engineering	
	Ubiquitous Knowledge/Sensing Network Defense →	Surveillance & Knowledge Systems

Lethality - Missiles

Lethality

Non Line-of-Sight Launch System
- Extended Range
- -- PAM >50 km/LAM >100 km
- Increased Loiter / LAM-60 min
- Increased Engagement Capability



CKEM
- FCS Spiral
- Lethality Overmatch
- 5 ft / 100 lbs
- On-the-Move Capability



NLOS-LS Air & Ground Variants
- Additional Missile Variants
- Networked Missiles
- Improved Affordability



Guidance & Control
- Precision Targeting
- Increased Kill



Seeker Technology
- Multimode
- Miniaturization
- Automatic Target Acq



Propulsion Technology
- Increased Velocity
- Longer Range
- Energy Management

Hypersonic Engine



Smaller, Lighter, Cheaper (SLC) Missiles
- Accurate/Maneuverable Urban Weapons
- Lighter/Cheaper Manportable Weapons
- Vehicle, Building & Personnel Targets

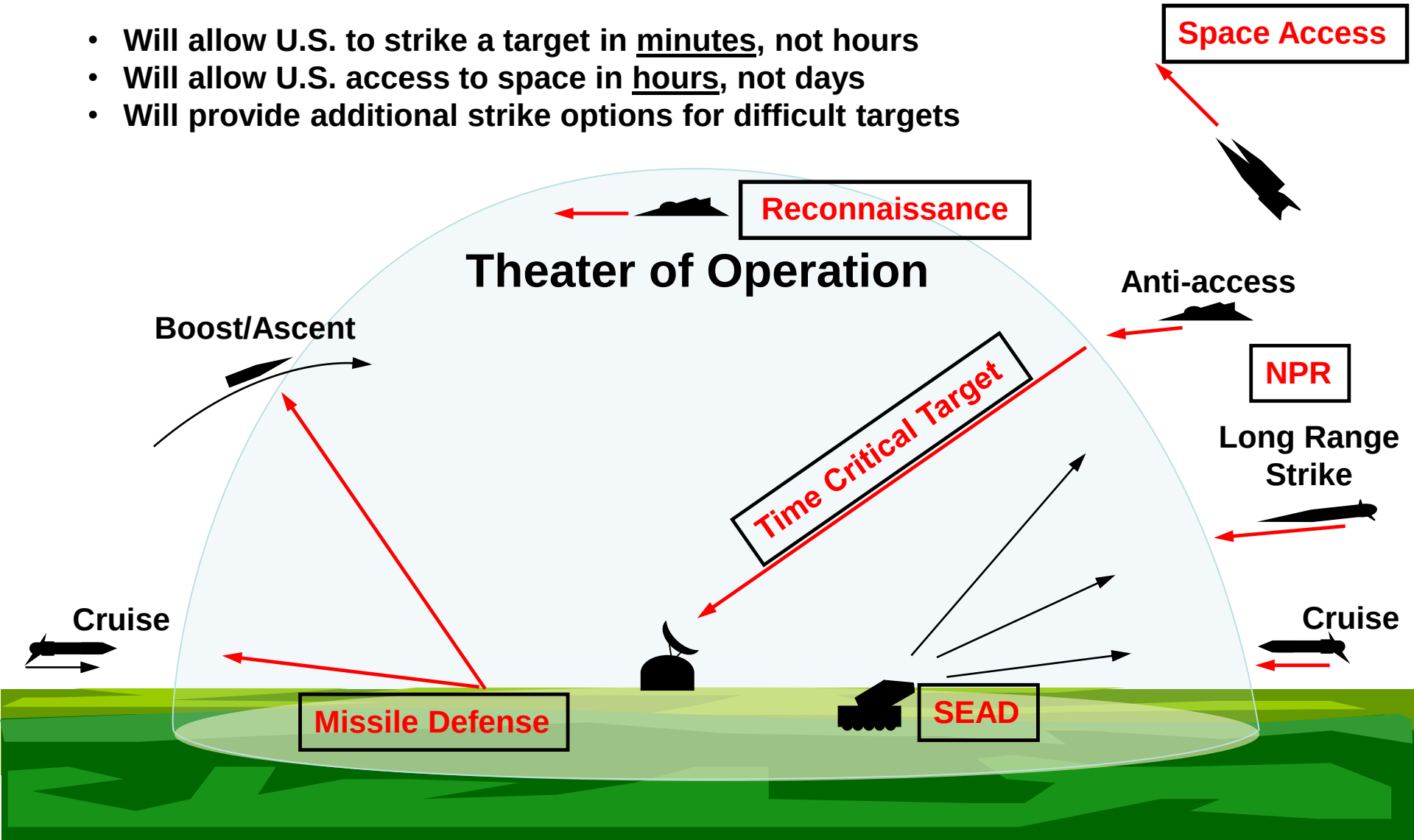
Defense Against Rockets, Artillery & Mortars & UAV/CM



Precision Missiles for FCS/Future Force

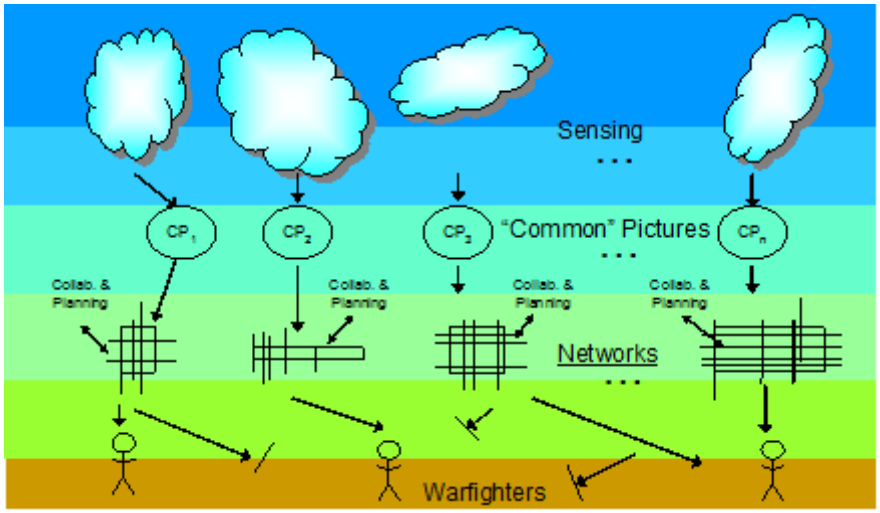
Value of Speed

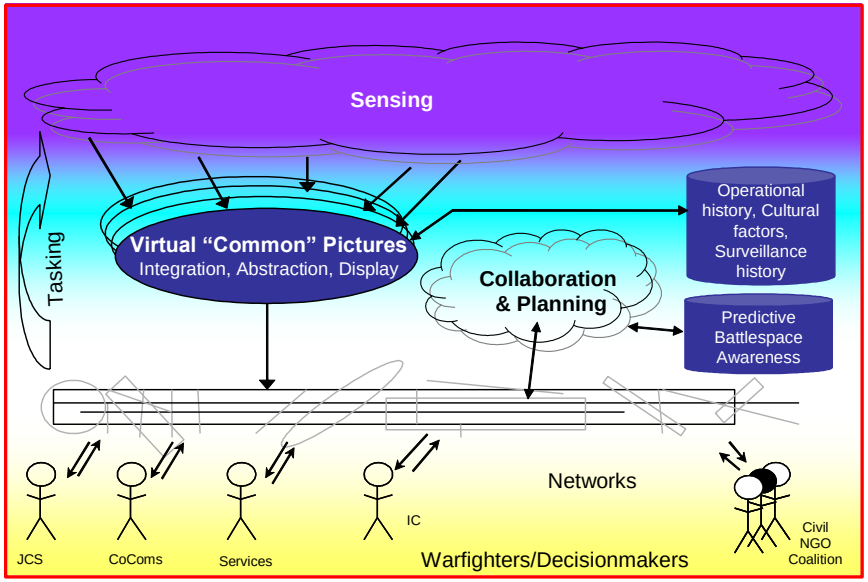
- Will allow U.S. to strike a target in <u>minutes</u>, not hours
- Will allow U.S. access to space in <u>hours</u>, not days
- Will provide additional strike options for difficult targets



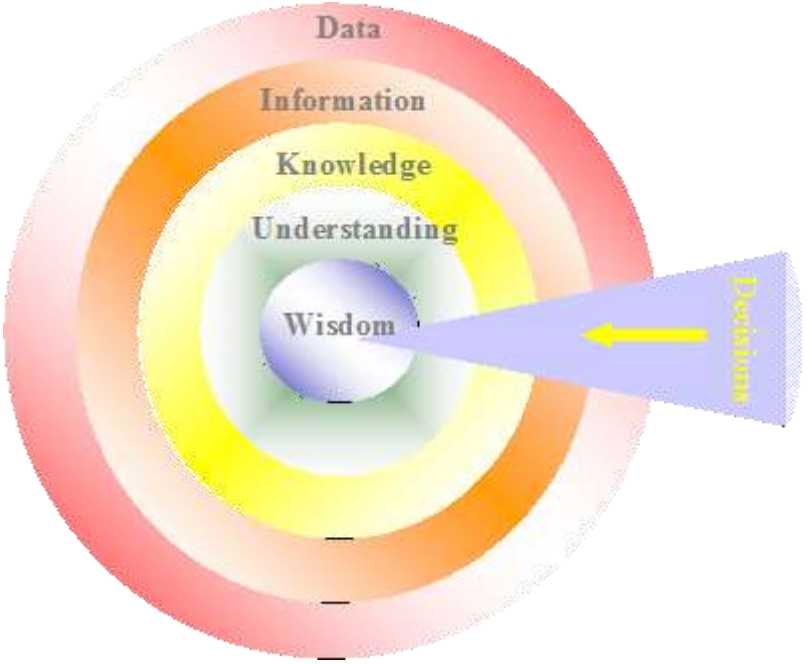
Surveillance and Knowledge Systems

Enabling Integrated C4ISR

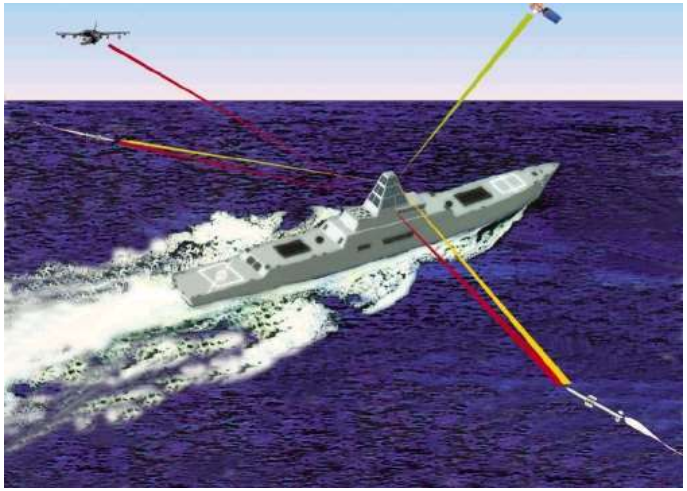


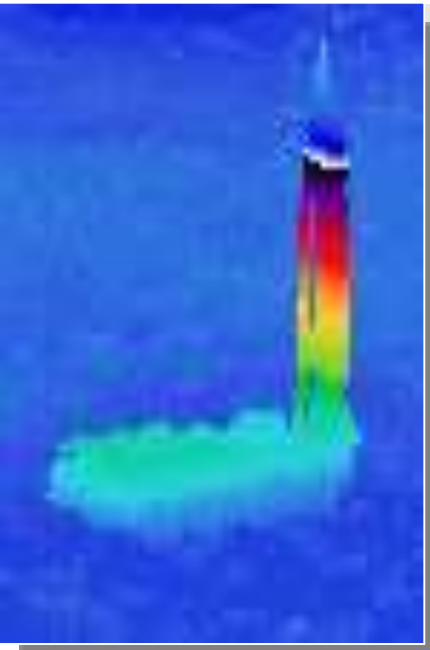


- **Adaptive Networks**
- **Ubiquitous Sensors**
- **Decision Aids**



Sensors Are Becoming Part of the System







Some Exciting Initiatives

- ***Interactive remote sensing:*** **Assisted sensing, laser imaging, 3-D sensors**
- ***Sensor webs & fusion:*** **Smart Sensorweb, proliferable microsensors**
- ***Advanced Multifunction RF System (AMRFS):*** **EW, RF, Radar, Comms**
- ***Microsatellites:*** **Multi-function/mission, cooperative sensor arrays in space.**



Power Technologies

Pervasive & Enabling

POWER GENERATION

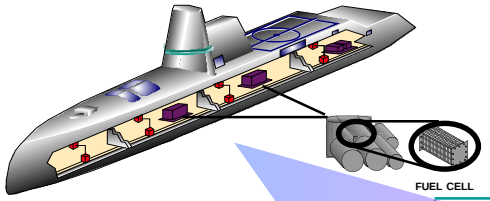
- Fuel Cells & Fuel Reforming
- Novel Power

ENERGY STORAGE

- Batteries
- Capacitors

POWER CONTROL AND DISTRIBUTION

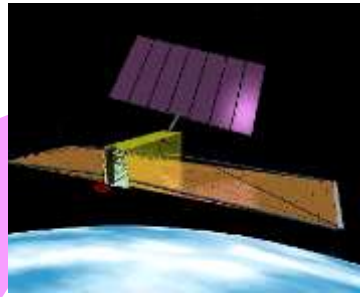
- Switching & Conditioning
- Power Transmission & Distribution
- Thermal Management



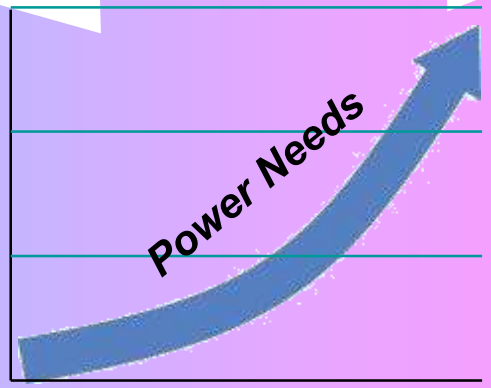
Electric Warship



More Electric Aircraft



Space Based Radar



High Power Microwave



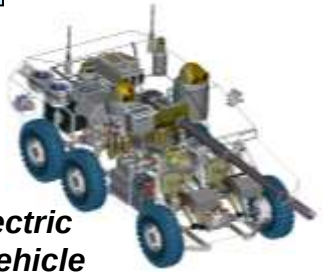
New Operational Capabilities



Warrior



Electric/Hybrid Weapons



Hybrid/Electric Combat Vehicle

HIGH ENERGY LASERS

Electric High Energy Laser Pulses Can:

- Cause thermo-mechanical damage
- Provide graduated lethality
- Offer low cost per kill

Applications/Missions:

- Illumination and range finding
- Ground and aircraft-based weapon
- Air and missile defense
- Ship self-defense







Required Technologies:

- 2X more power efficient diode packages
- 100X increased diode package reliability
- 10X higher individual slab/rod/fiber power levels
- Beam combining techniques
- Improved thermal management (10X lower weight)
- Weight efficient power conditioning (pulsed & CW) [10X lower weight]

Warfighter Payoff

- Greatly reduced logistic needs (gal's of JP-4 vs $1M missile)
- Increased Lethality against:
  - -- Boosting TBMs
  - -- Maneuvering Threats
  - -- Swarm Threats
  - -- Threats in close proximity to noncombatants

High Power Microwave (HPM) Weapons

High Power Radio Frequency/Microwave Pulses that can:

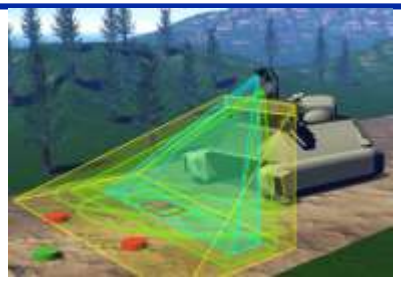
- Upset and/or Damage Electronics
- Produce Non-Lethal Effects on Personnel
- Floods Target Area - High P_{hit}
- Rheostatic Target Effect (Temporary to Permanent)

Applications/Missions:

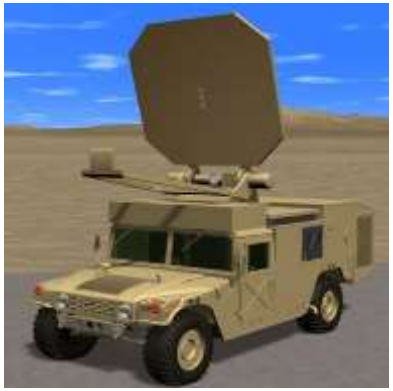
- Counter Command and Control/Infrastructure, etc.
- Vehicle/Platform Protection (Counter Mines/ Munitions)
- Anti-Personnel/Area Denial/Crowd Control
- Air/Missile Defense

Required Technologies:

- 75% Smaller High Power/Gain Antennas
- Effects/Sources Modeling and Simulation
- Pulse Power for Mobile Platforms
  - 2X Operating Voltage for Pulsed Switches
  - 4X Energy Density for Capacitors
  - 2X Operative Voltage for Power Distribution Cables



Counter mines/munitions



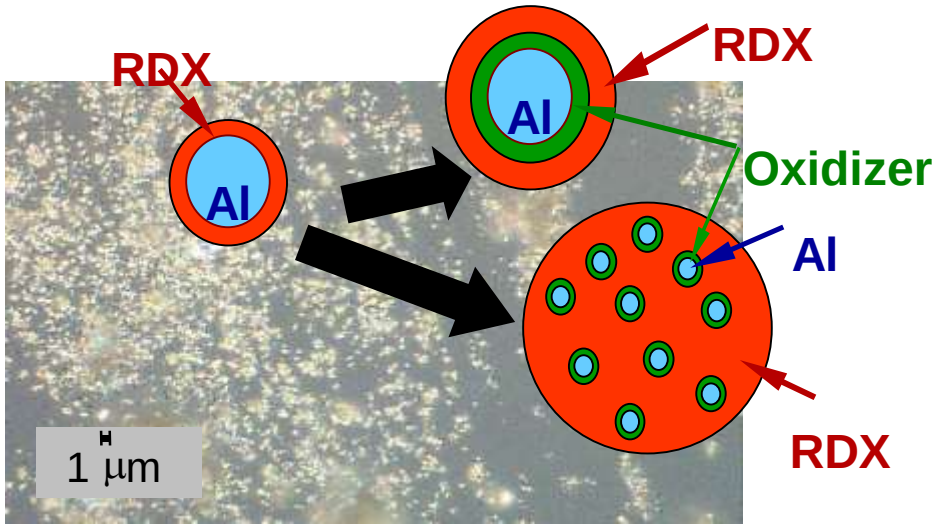
Counter personnel (non-lethal-to-lethal)

Warfighter Payoff

- 40% system weight reduction
- 90% system volume reduction
- Low collateral damage
- Greatly reduced logistics

Nano Energetics Example

Potential Payoff in Revolutionary Explosives

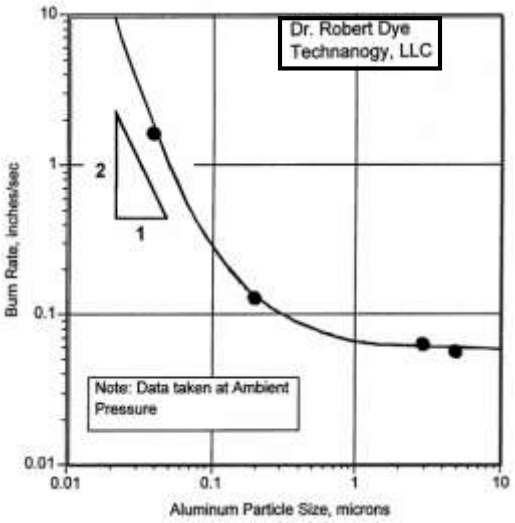


Nanoscale Aluminum, Coated by RDX

Nano fuel particles coated by oxidizer

- **100x power – increase in energy release rate**
- **2x total energy – greater surface and internal volume free energy available**
- **10x efficiency – near 100% complete reactions**
- **10x safer – lower sensitivity to mechanical initiation**
- **More compact - no binder**

Burn Rate vs. Particle Size

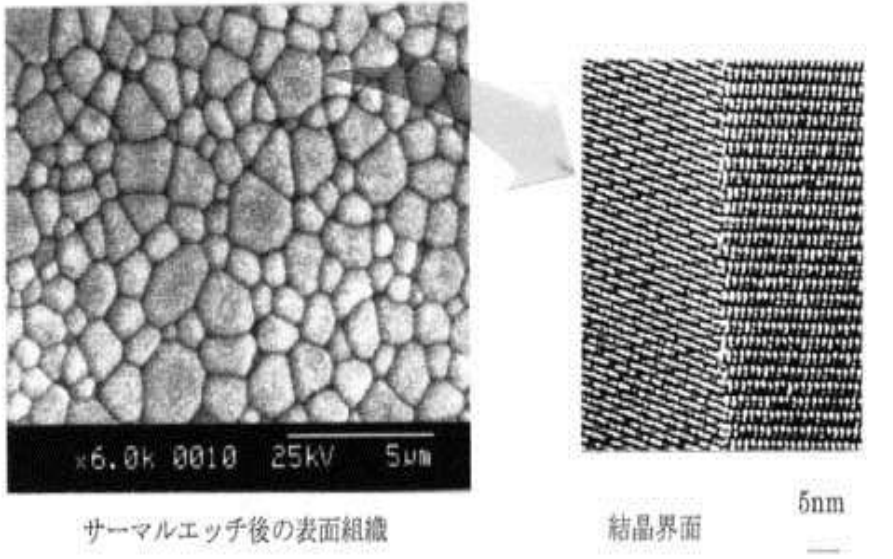


Payoff to the Warfighter

- **Smaller, safer munitions**
- **More kills per event**
- **Decreased logistics tail**
- **Enables small, weaponized UAVs**

Foreign Example

Nanocrystalline / Nanostructured materials



UNCLASSIFIED

Developed by Konoshima Chemical Co

PLM - higher strength & toughness; Larger sizes; Currently 20% less expensive

Technology can be applied to :

- **Transparent armor**
- **Electromagnetic windows**
- **IR dome materials**
- **Sensor windows**
- **X-ray scintillator materials**

- **Japanese novel patented process to produce YAG nanoparticles**

- **Liquid-phase chemical reaction**
- **No pressure required, low temp.**
- **100 nm average diameter**
- **Largely homogeneous**

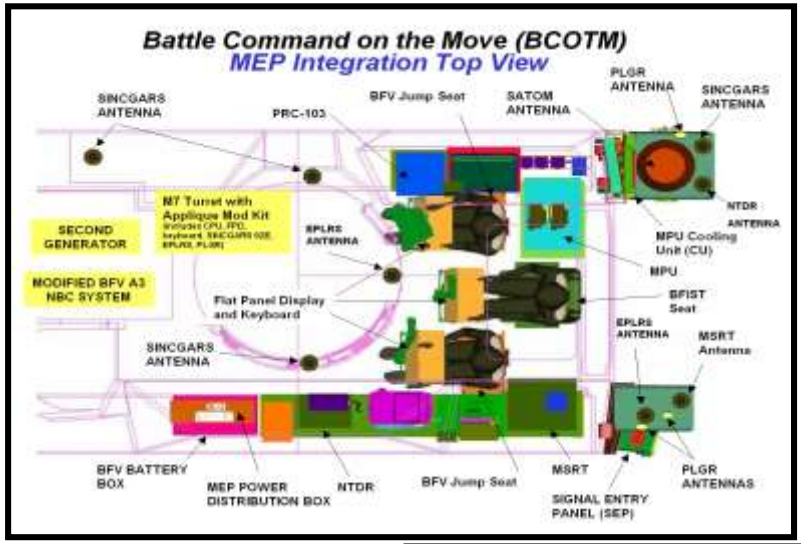
The Future

- **Office of the Director, Defense Research and Engineering asked to study Disruptive Technologies**
  - **Will impact Quadrennial Defense Review formulation**
  - **Probable FY06 start-up initiative**
- **Disruptive Technologies are uncertain**
  - **Final use may not be predictable**
  - **Need to “seed” lots of efforts**
- **Seeking help looking to the future**

Disruptive Technology Example: National Aerospace Initiative

Disruptive Technology Example: Surveillance & Knowledge Systems

Example of Impact in OIF





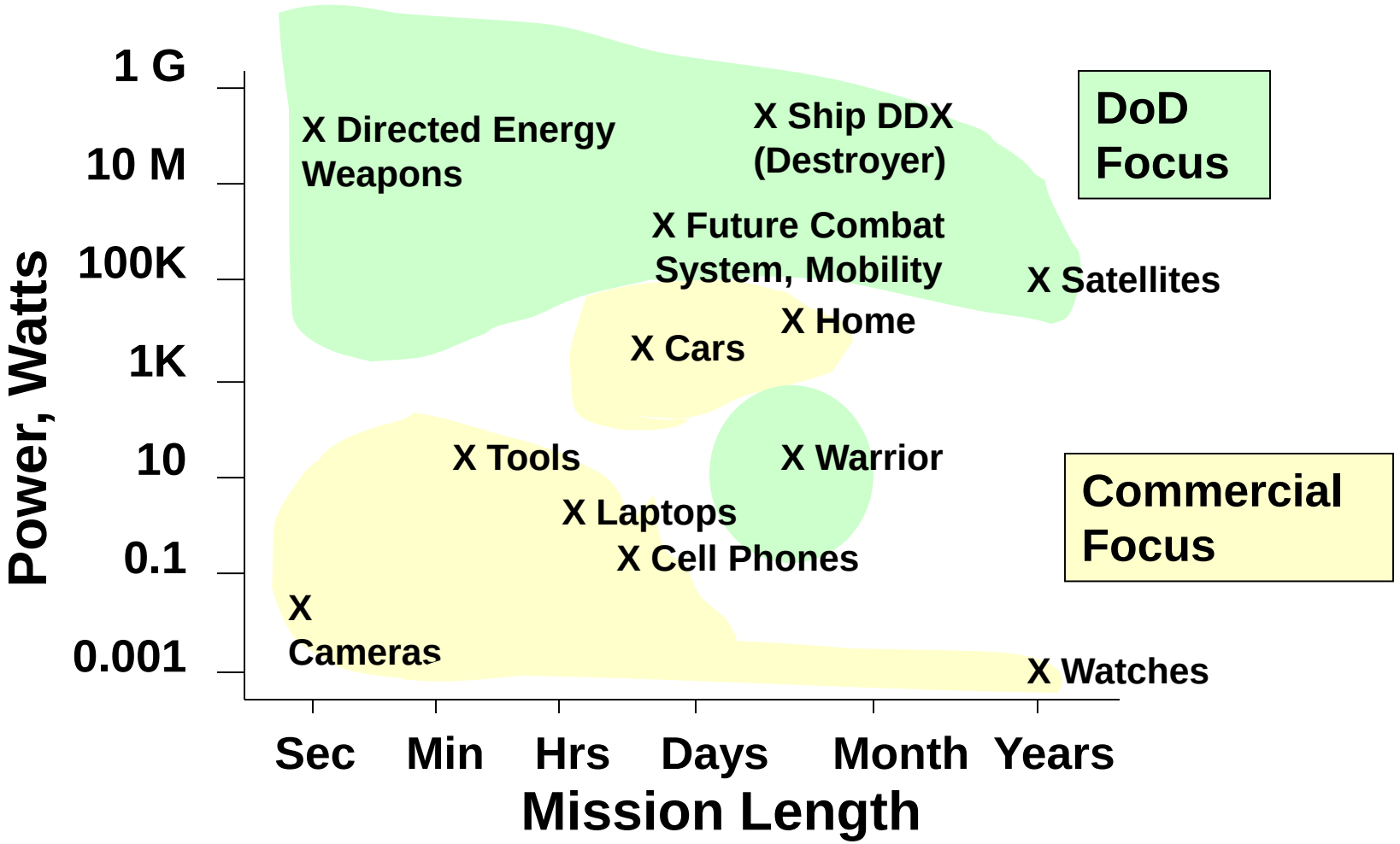
Battle Command on the Move (BCOTM)

In support of PM-Platforms and PM-Bradley, CERDEC designed and developed the Mission Equipment Package (MEP) installation for the BCOTM platform for the 4th ID. The installation integrated the BFA Computer Systems (AFATDS, AMDWS, FBCB2, MCS, ASAS) into a C2 system that provides near real-time battlefield information focused on intelligence, effects and maneuver. Five M7 Bradley vehicles were modified and delivered to the 4th ID within 40 days of project initiation. They are currently deployed for use in OIF, providing the battlefield commander the unique capability of maintaining situational awareness and effectively executing battle command tasks while on-the-move and not tethered to his Command Post.

Freeing the Commander from the Fixed Command Post

Disruptive Technology Example: Energy & Power Technologies

Energy and Power Technologies



The Objective Force Army

Today



~100 lb. load



70+ tons



0 mph

From Platforms to System of Systems



C-130-Like Transportability

Future Force

< 40 lb. effective load



Fully networked

< 20 tons

> 40 mph

Accelerating Transformational Capabilities

“Discovery to Deployment”

(S&T must address near-term objectives & long-term challenges)

How we work:

Present . . .

Today’s
Navy and
Marine Corps

- **Naval Research Enterprise**
- **Technology Solutions**
- **NR-Stat**
- **Swampworks**

~2%

5 Years . . .

The Next
Navy and
Marine Corps

- **Requirements-Driven FNCs**
- **Transformational Technologies**
- **Fleet/Force Experimentation**

~50%

5 ⇨ 20 Years . . .

Navy and
Marine Corps
After Next

- **Idea Exploration**
- **Naval Unique / Essential**
- **Grand Challenges**

~48%

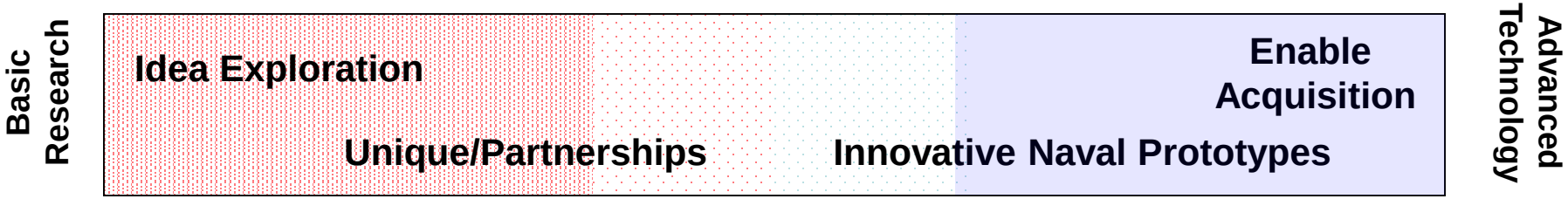
6.3 **6.2** **6.1**

Exploitation & Deployment | Discovery & Invention

Note: Percentages indicate approximate division of total DoN S&T annual investment in each area.
Updated 22 Apr 2003

ONR Strategic Investment Scheme

Discovery and Invention (D&I) **Exploitation and Deployment (E&D)**



Naval Research Diversity (Idea Exploration)

- Science shortfalls in topics with Naval interest
- Nurturing science opportunity
- High impacts/surprises

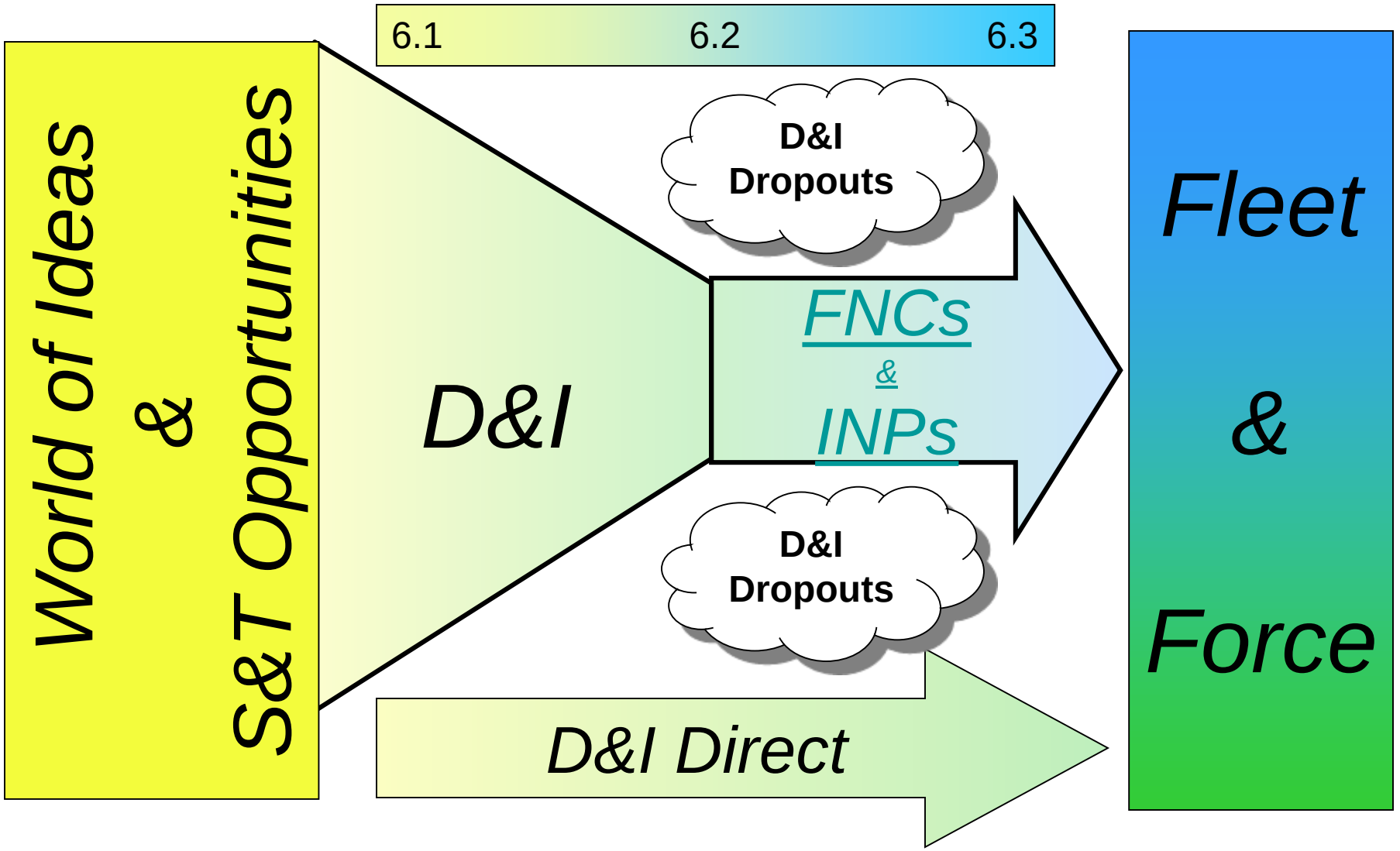
Naval Unique/Partnerships

- National Naval Responsibilities
- Core Competencies
- Health of Academic pipeline – ideas/workforce

Accelerating Discovery into Innovative Technology

- S&T specifically focused on enabling capability
- Harvest other agency S&T toward Naval applications
- Pushing toward Maturation

Overall DoN S&T Product Flow



S&T POM 06 Investment Areas

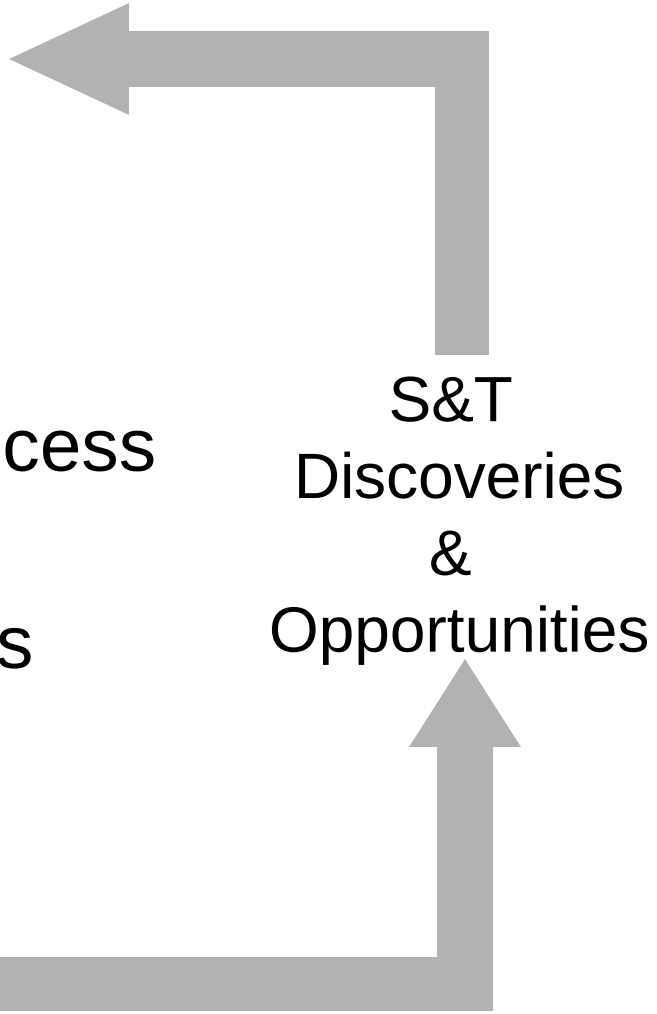
FY 06 $1,776M

Naval Power 21 Acquisition Enablers ($551M – 31%) • FNC's (TOG Oversight) • Warfighter Protect • Capable Manpower (N1/N00T) • LO/CLO (PMR 51) • GPS (enhancement) • InfoSecurity Protect (N6/SPAWAR) • USCG Vessel Tracking (ASN(RDA))	**Discovery & Invention ($713M - 40%)** • Naval scientific disciplines • NRL/Warfare Centers • National Naval Responsibilities • HM&E (facts of life) • Technical workforce sustainment • High impacts/surprises
OSD Directed ($330M – 19%) • JFCOM's Joint Experimentation • POM-04 PDM (except EM Rail Gun) • PBD's and earmarks	**Leap-ahead Innovations ($182M -10%)** • Innovative Naval Prototypes • Swampworks • Tech Solutions • SEA TRIAL • Fleet/Force Response Programs

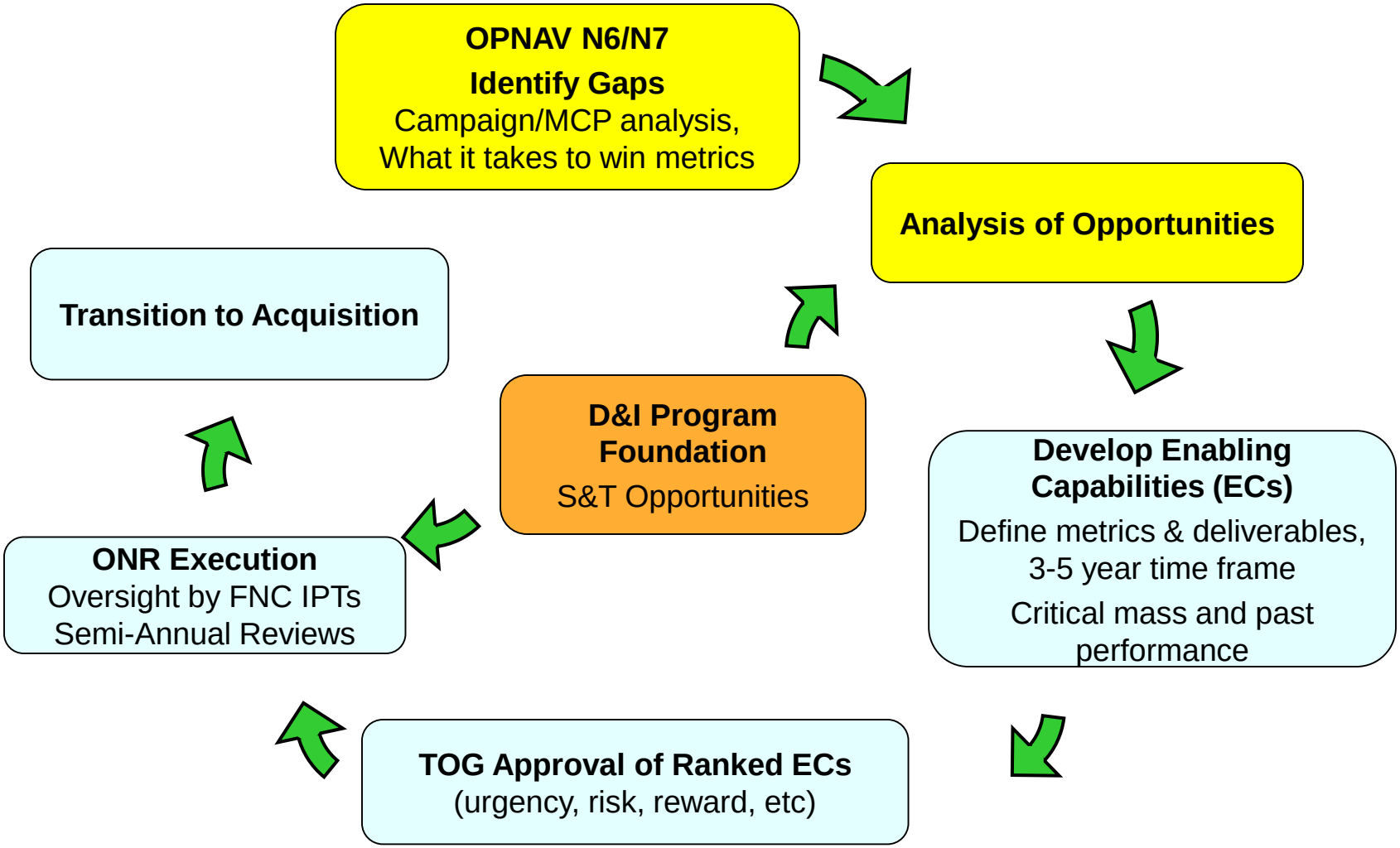
D&I Investment

DoN Vision – Naval Needs – S&T Opportunity

- DoN Vision & Guidance
- Naval Power 21
- Capability Development Process
- S&T Options & Opportunities
- D&I Investment Process

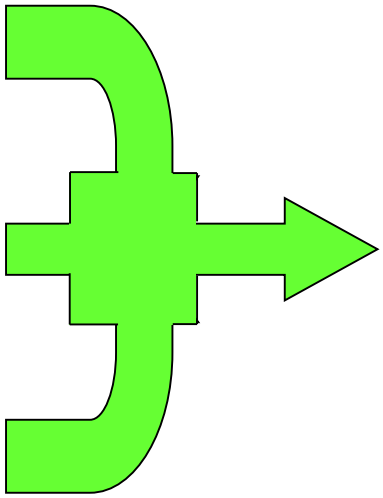


D&I to FNC Process



Key S&T Pathways to Resolving IED Threat

- Detection at a Distance
- Destruction at a Distance
- Defeat at a Distance



Deter

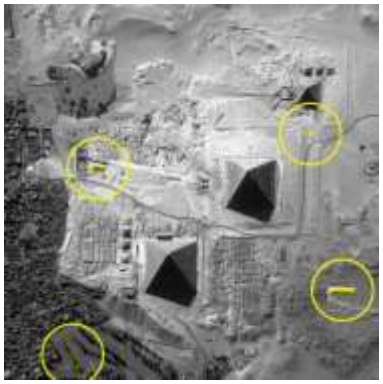
Examine entire IED delivery chain to develop systematic countermeasures

Obtain Funds

Develop Organization



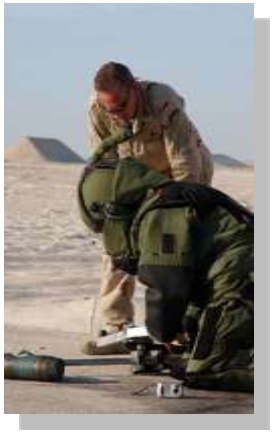
Gather & Provide Material



Improvise CONOPS/ Tactics/ Devices



Plan Attacks





Perform Attacks





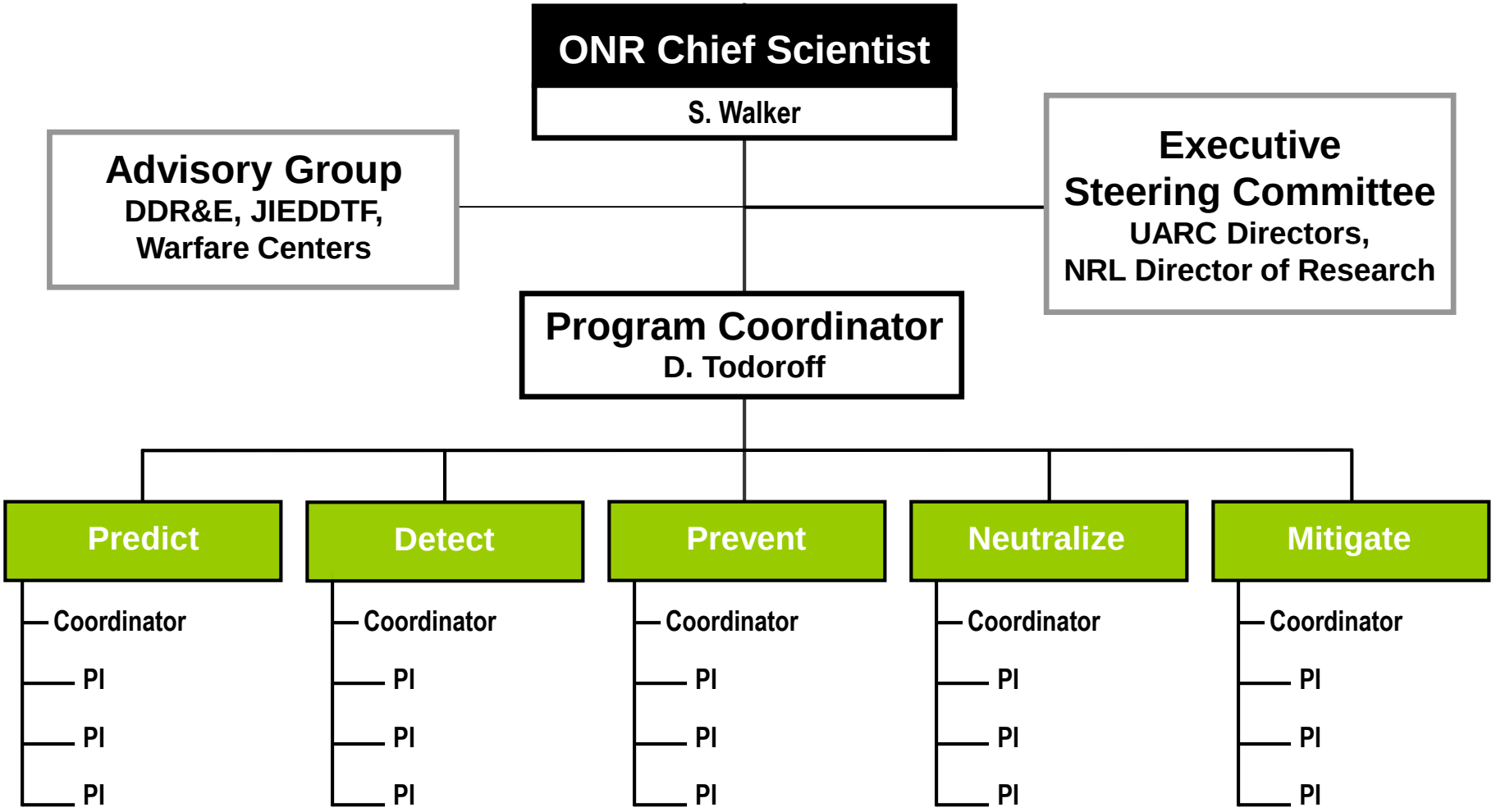
Consequence Management

Attribution

Counter-IED Strategic Research Vision

STAGE	Predict	Detect	Prevent	Neutralize	Mitigate
CAPABILITIES	• HUMINT • PSY OPS • Behavioral Pattern Recognition • ISR / COMMS • Forensic Analysis	• Sensors • Stand-off Detection • False Alarm Reduction • Pattern Recognition • Remote Surveillance	• Deny enemy comms • Deny enemy free movement • Deny enemy ISR • Control access to materials • Jamming	• Render IED safe • Disposal • Controlled Detonation • Forensic collection • Enemy Interdiction	• Blast resistance • Blast containment • First responders • Medevac • Information Operations
RESEARCH THRUSTS	• Psychology & Sociology of Terrorists • Information Management • Pattern Recognition • Artificial Intelligence • Explosive Characterization	• Sensor Technologies • Signal Processing • Data Fusion • Pattern Recognition • Autonomous System Technologies	• RF Communications • Non- Lethal Weapons • Information Management • Artificial Intelligence	• Chemistry /Physics of Explosives • Energy-based Weapons • Autonomous System Technologies • Tagging / Marking	• Protective Structures • Armor • Knowledge Management • Information Technology

Counter-IED Organization



Session IIIB: S&T Executive Perspectives on Getting Technology to the Warfighter

This session will focus, from an S&T perspective, on potential roadblocks to getting technology to the warfighter. Specific issues to be addressed are the right balance between technology transfer and technology base, the proper organizational structure for S&T, the role of industry, challenges for collaborative S&T, and how the S&T community fits in the new approach to capabilities based planning and acquisition. The panel format will be questions posed by the chair with point/counter-point discussion from the panel.

Co-Chairs: Colonel Mark Stephen, USAF, Chief, Science and Technology Division, SAF/AQRT
Dr. John Solomond, Program Manager C4ISR, Booze Allen Hamilton

Moderator: Mr. James Engle, Deputy Assistant Secretary of the Air Force (Science, Technology & Engineering)

3:45 pm

Dr. Charles Holland, DUSD (Science & Technology)
Dr. Tom Killion, Deputy Assistant Secretary of the Army (Research & Technology)
Dr. Starnes Walker, Chief Scientist, ONR
Dr. Robert Leheny, Deputy Director, DARPA
Ms. Sue Payton, DUSD (Advanced Systems & Concepts)

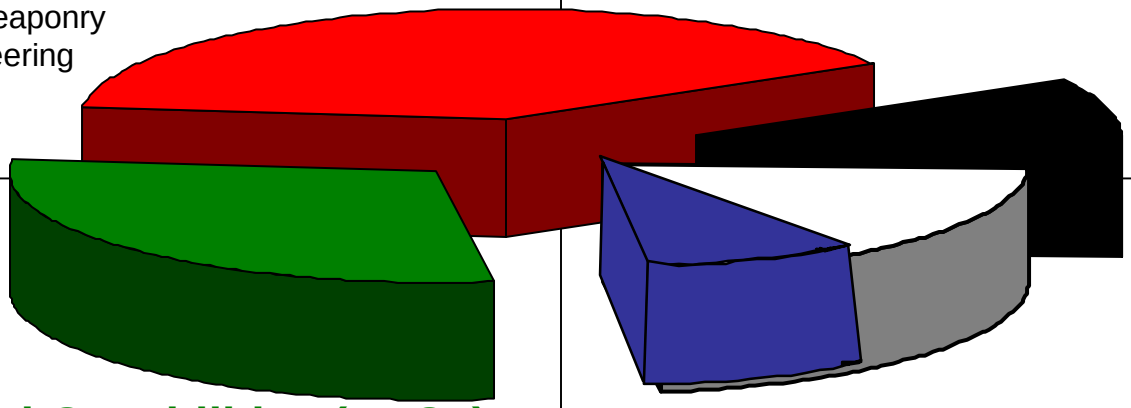
S&T Investment Categories

Discovery & Invention (D&I)

- NRL Base Program
- Science shortfalls in topics with Naval interest
- Nurturing science opportunity
- High impacts/surprises
- Health of Academic pipeline – ideas/workforce
- National Naval Responsibilities
  - Ocean Acoustics
  - Undersea Weaponry
  - Naval Engineering
  - Naval Air (proposed)

Innovative Naval Prototypes (INPs)

- *TBD*



Future Naval Capabilities (FNCs)

- Time Critical Strike (TCS)
- Organic Mine Countermeasures (OMCM)
- Knowledge Superiority & Assurance (KSA)
- Littoral Antisubmarine Warfare (LASW)
- Expeditionary Logistics (ExLog)
- Fleet/Force Protection (FFP)
- Littoral Combat and Power Projection (LCCP)
- Missile Defense (MD)
- Advanced Capability Electric systems (ACES)
- Autonomous Ops (AO)
- Total Ownership Cost Reduction (TOC)
- *Capable Manpower (CM)*
- *Warfighter Protection (WP)*

Quick Reaction and Other

Quick Reaction

- Swampworks
- Tech Solutions
- MCWL

Other

- Pass-Through - to JFCOM
- OSD Directed
- Infrastructure - Efforts enabling ONR's mission execution such as IFO, conferences, outreach